A FIRST BOOK
IN
METAPHYSICS

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TO

A. H. M.

PREFACE

This book is planned to be a student's first book in philosophy, though the course which it outlines may either precede or follow a course in the history of philosophy. In writing the book I have had in mind to fulfil the following three purposes: First, I wished the book to be simple, clear and definite, and as brief as possible in order that the student using it might devote by far the larger part of his time to further reading. That is, the book should form a system of closely connected topics, an outline to be filled in by extensive outside reading and an outline to keep this reading from becoming hopelessly confusing. This reading should be selected from current philosophical literature and especially from those philosophical classics which are intelligible to the beginner.

Secondly, I wished to write, not an outline of the historical development of the problems of metaphysics, nor a long discussion regarding the definition and division of philosophy, nor again an account of rival philosophical schools and their theories, but a book in metaphysics, a book representing consistently one contemporary philosophical tendency. This forced the book to be partisan, but I believe that the beginner demands, and has the right to demand, a modern philosophical creed. Later he may have to outgrow this creed, but

in the meantime he insists upon being a partisan and takes little interest in being led through a philosophical museum. Accordingly, following my own philosophical convictions, I have tried to formulate briefly and rigorously that type of neo-realism which is a return at least to the spirit, though not always to the letter, of Plato and of Aristotle.

Lastly, I wished to adapt the book especially to the Oxford or preceptorial method of instruction. According to this method, the text-book and the lectures in class should serve to give a general view of the subject but should play a far less important part than the student's independent reading and study. The results of this reading and study should be expressed in a weekly, or better fortnightly, essay submitted to the preceptor and afterward discussed with him in an informal conference held preferably in his private study and attended by not more than three or four students. This enables the teacher to deal with his students as individuals and to vary greatly the amount and kind of reading he assigns to each. Some will do not only more difficult reading than others but three or four times the amount of reading.

Besides being adapted especially to the use of undergraduate students in philosophy, the book is, if I mistake not, adapted also to the use of graduate students as an outline of a course of reading in metaphysics.

A few words should be added regarding the reading I have selected to which to refer the student. One has to select from writings which are easily available and, unfortunately, as far as possible only from those in the

English tongue. Hence, it is often a matter of good fortune to find articles or chapters which fit precisely the subject of study and which are suitable for the beginner. However, this responsibility will be shared with me by every instructor who uses the book, for not only can he add to or select from the list of readings which I give but he can do what of course the book itself can not do, keep selecting from new articles and books as they appear. My chief regret is that many of the great classics, especially the logical and metaphysical writings of Aristotle, are not intelligible to the beginner and therefore have had to be either omitted or assigned only for advanced reading.

WALTER T. MARVIN.

GREENSBORO, VERMONT,
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CONTENTS

PART I. INTRODUCTORY

PART II. THE NATURE OF SCIENCE

PART I

INTRODUCTORY

A FIRST BOOK IN METAPHYSICS

CHAPTER I

DIFFERENT VIEWS REGARDING THE NATURE OF PHILOSOPHY

1. *Introduction.*—In this chapter we are to reason about philosophy, not to study philosophy itself. We are forced to do this in beginning an elementary book in philosophy because radically different opinions exist among philosophers themselves as to what philosophy is, that is, as to its proper subject-matter and as to the valid methods of philosophical research. Some thinkers believe that philosophy is a science and that it should be discovered and reasoned out by methods which are distinctly scientific; whereas other thinkers regard it as fundamentally unlike science. Either they believe that it is an imaginative or esthetic insight, as is poetry or painting, or they believe that it is a different sort of intellectual procedure from the research which gives us the special sciences.

To understand these different opinions regarding the nature of philosophy without taking sides in the issue itself forces us to study them from the point of view of psychology. In so doing, we shall see that the differences involved result from differences in the mental life of the various philosophers. Philosophers are men of markedly unlike temperament. For some the scientific interest is

dominant, for some the religious interest, for others the moral, and for still others the esthetic interests are supreme. The philosopher with the scientific temperament is not always troubled if philosophy fails to furnish him a religion; whereas the philosopher with strong religious temperament may have as his sole interest in philosophy the insight it can give him into the world as the environment of man's spiritual life and as the means of fulfilling his spiritual aspirations. Similarly the man with pronounced artistic temperament may seek in philosophy only the means of satisfying his esthetic desires regarding the world; and finally the man whose mental bias is wholly moral may narrow his philosophical interest to the one problem, the world as the scene in which man fights for the good and wins the victory over his baser nature.

Philosophers are men not only of unlike temperaments but also with different experiences, men possessing different sorts of knowledge, men who react differently to the abstract arguments and results of the special sciences. One man's experience may be narrow and provincial, another's extensive and even world wide. One may be trained in the exact sciences, another may be chiefly a psychologist, sociologist or anthropologist. One may be a student of theory, the other may be a man of action. One may be interested in the abstract sciences, may be impressed with the exactitude of mathematical and experimental research; the other may dislike such study but love the concrete world of nature and of life with its wealth of detail and with its unfailing variety.

It would take us far beyond the purpose of this chapter

to trace out the results of all these mental factors in the history of philosophy. It fulfils the purpose to emphasize two general types of belief regarding the nature of philosophy, *the belief that philosophy is a matter of feeling or esthetic insight* and *the belief that it is a science.*

2. *The belief that philosophy is a matter of feeling and appreciative insight.*—If philosophy is a matter of esthetic insight, philosophy cannot be called either true or false, it cannot be demonstrated or given a rigorous verification. Rather it will be like the styles and customs in literature or art. Now this philosophy, now that, will be widely received and welcomed by different peoples and different ages. There will be as many philosophies as there are different temperaments and different types of human experience. There will be mysticism with its distrust of reason. There will be naturalism with its distrust of religion. There will be obscurantism and there will be radicalism, there will be allegiance with ecclesiasticism and again bitter hostility to the church, there will be optimism and pessimism, there will be stoicism with its single-hearted devotion to the moral law, and there will be rationalism with its emphasis upon the universal reign of order. Under such conditions it is utterly idle to expect men to agree philosophically or to endeavor to bring about a consensus of opinion regarding the solution of fundamental philosophical problems. In short, the world cannot be understood, it cannot be made the subject of theory, it can only be felt and lived.

However, the philosopher himself who holds these views regarding philosophy is very often an advocate of

a distinct philosophical theory, and perhaps we can best express the difference between him and other philosophers by calling him a *perceiver* and them *thinkers*. The perceiver loves the concrete, and distrusts the abstract. To know the world you must be part of it, live it, drink deeply of the cup of life, in short you must *perceive* the world. The world cannot be known in terms of the abstract sciences, in terms of logic. The world is not a logical puzzle. It is rather a living, growing, evolving concrete object, of an infinite variety which completely baffles abstract thought and system. This type of philosopher is usually called a romanticist. He refuses to be held down to precise and rigorous logic. He needs and demands poetic license.

3. *The belief that philosophy is a science.*—Opposed to romanticism is the belief that philosophy is a science. If philosophy is a science then not only is it true or false but it can be demonstrated. Philosophers may disagree as to what the words true and false mean and as to the limits to which philosophical research can attain; but in any case there is agreement that the philosopher as a seeker after truth is called upon to verify his assertions. The differences in belief among philosophers are not due to any cause which makes a consensus of opinion impossible, rather they are due to the difficulty of the problems, to the imperfect insight of the student or to the errors of his training. These differences between philosophers will in time gradually disappear as further knowledge and insight, further mutual understanding and discussion, make the problems and their solutions thoroughly explicit.

In general, however, there is a radical difference of opinion within this philosophical group itself regarding what science is and therefore regarding the nature of philosophy. To one, science seems to be a mere instrument invented by man, by means of which he can adjust himself to environment and satisfy his needs. To this philosopher, truth is not something absolute, fixed, or invariable. It is but another name for perfect adjustment. To the other philosopher truth is absolute and invariable. Science is the discovery of something entirely independent of man, and of his struggle for existence and happiness. As a consequence of this difference, philosophy seems to the former thinker to be solely a study of man, of his history and of the processes by which he has become in part master of his environment. But to the latter thinker philosophy is a science of the world, a world not made by man, a world whose general nature is fixed and determined regardless of human history. The former philosophers are nowadays called pragmatists or subjectivists and the latter might be called objectivists or intellectualists. But these names are quite ambiguous, and they should be used therefore with utmost caution.

The objectivist party, or better, the scientific party in the narrow sense, is again divided into two distinct groups or types. Let us for convenience call them the monists and the pluralists, though again these names are thoroughly ambiguous. The monist starts with the conviction that the goal of science is to understand the world *as a unity*. Any knowledge of things that leaves them independent and not unified brands itself *ipso facto*

as incomplete and imperfect. The ultimate and sole problem of science for the monist then is to understand how the many things of the world, how the infinite variety and change found in the world, all constitute one system or whole. This philosopher is compelled to build up such an understanding not by starting with the many and various objects and events of nature but by starting with certain axioms or *a priori* convictions regarding the world and deducing his theory of reality largely therefrom. He cannot really use the knowledge put at his disposal by the special sciences, because it is never complete enough for his purpose. He must get some infallible and universal truths by direct means. In short, he is what is called an absolutist and his method is *a priori* and deductive. As a consequence, under his leadership philosophy becomes quite divorced from the rest of science. It is of little, if of any, help to the special sciences as they are of little assistance to it. Moreover, the doctrine is entertained that the special sciences are less certain, less valid, than philosophy, that they are only relative or imperfect truth, whereas philosophy is absolute or perfect truth.

This divorce from science seems to the pluralistic opponent not only unfortunate but disastrous for philosophy. Thoroughly as he may agree with the monist that we are to seek to unify our knowledge, to search for the interconnection between things, nevertheless he is convinced that the monist's method leads directly and inevitably back to romanticism and mysticism. It may indeed be that the world is a unity but there are no sound methods of research known to man

other than those used and developed in the special sciences. We must be content to go slowly; we must be content to wait for the results of science, to accept probabilities and to live by them; we must be satisfied with an imperfect incomplete knowledge. The most certain body of knowledge is science, especially the exact sciences; and the philosopher can ignore this only at his great peril. Thus the pluralist is in close sympathy with science. His methods are the methods of science, his information starts from science. He believes that the philosophical problems must be kept open as scientific problems are kept open. There is no short cut to the goal. There is no infallible judge to tell us when our work is done and the race completely won. There are only the individual daily triumphs to assure us that we are making progress.

4. The standpoint of the present book.—The author confesses that he belongs to the last party, the pluralists, but he confesses at the same time his fear of all partisanship. No doubt the world's work gets done by strong partisans, but strong partisans are seldom wholly right in what they deny. The philosopher especially needs to distrust his own party enthusiasm even though he needs also to cherish it in the interest of progress. The chances are that in the long run we shall need all the help, the suggestion, and the insight the great philosophers of every party and creed have given the world. The chances are that one man's eyesight is better in one environment than is another man's, that our differences are thus in part due to the greater emphasis different facts receive. The field of perception is far broader than the field of

precise and verifiable knowledge; and this means that the pluralist should be most tolerant toward the views of other philosophers and of leaders in religion, art, literature and life, for though their views may not be scientific they may contain the raw material of science. We must not forget the history of science itself. Science is of humble parentage, for it grew out of vague insights, analogies, and obscure feelings. Yet though the field of vague perception is broader than that of precise perception, this does not indicate a permanent state of affairs. It indicates rather the need of growth and the likelihood of growth.

However, let this be as it may, even should the pluralist be wrong in what he denies, surely he cannot be wrong in what he affirms. There is, undeniably, a philosophy of science or a scientific philosophy. Though this may have limits which will forever prevent it from fulfilling the philosopher's highest aspiration for knowledge; still it is a body of valid knowledge having a right to a place in the hierarchy of the sciences. In short, the pluralistic metaphysics must be given a place somewhere in the philosophy of all thoughtful men.

Of course my own conviction remains that the pluralist is right also in what he denies, that he is right in maintaining that the sole path of progress open to philosophy is the scientific highway. No matter how helpful side excursions may be in telling us of the country beyond, such pathways end in swamps and jungles. To drop figures of speech, philosophy should be brought into closest relation to science and should be the genuine result of man's entire scientific achievement. Of course

it must be the result also of man's religious, moral and esthetic insight. But even as such it must still remain rigorously scientific. Perhaps I can indicate to the student of the history of philosophy my point in no better way than to urge that the modern philosopher would do well to take as his ideal the greatest of ancient philosophers, if not the greatest of all philosophers, Aristotle.

FOR FURTHER STUDY READ:

Woodbridge, The Enterprise of Learning, *Columbia University Quarterly*, June, 1912;
Santayana, The Life of Reason, I, 1–32;
James, Pragmatism, Lect. I;
James, The Will to Believe, Essay "The Sentiment of Rationality;"
James, A Pluralistic Universe, Lect. I, "The Types of Philosophic Thinking;"
Boodin, Truth and Reality, 3–14;
Perry, Present Philosophical Tendencies, Chap. II, "Scientific and Religious Motives in Philosophy;"
The New Realism, New York, 1912, Introduction;
Sheffer, Ineffable Philosophies, *J. of Phil., Psychol., etc.*, 1909, *6*, 123.

FOR MORE EXTENSIVE STUDY READ:

Stein, Philosophische Strömungen der Gegenwart;
Perry, Present Philosophical Tendencies.

CHAPTER II

THE DEFINITION OF PHILOSOPHY AND OF METAPHYSICS

1. *The difficulty of defining philosophy.*—This book is intended to acquaint the student with an important branch of philosophy called metaphysics, by revealing its chief problems and by expounding certain solutions of these problems which philosophers have offered. Unfortunately, a difficulty confronts us at the very start, for, as we have seen, men disagree as to what is meant by the words *philosophy* and *metaphysics*, and it is not easy to make their precise meaning apparent. As a consequence, many of the first pages must be devoted to the preliminary work of learning what we are to study, when it would seem so much more direct to begin at once with the main subject-matter. Yet in fact we shall be beginning with the main subject-matter; for to understand precisely what the words philosophy and metaphysics mean, is to solve some important philosophical problems and therefore to be already well started in the subject.

2. *The cause of this difficulty.*—The cause of this difficulty in defining philosophy is twofold. First, the things, or entities, which the philosopher studies, are highly abstract; and the truths which he seeks to discover are highly general. Now it is easy to point out animals or rocks or stars, and to say, "These are what we are to study," for these things are concrete and are

readily perceived; whereas things which can be seen only by the educated or discriminating eye, like the things denoted by the symbols and formulæ of the abstract sciences, for example, of mathematics, cannot be perceived until we have been technically trained. Again, it is easy to make clear even to a child the particular truth, "This fire is hot and will burn;" but it is most difficult to make clear the general truth, "All forms of combustion are instances of oxydation." Hence philosophy, the most abstract and the most general of all the sciences, studies things and problems which usually quite escape our notice and which can be revealed only to the thoughtful and discriminating mind. On this account, too, philosophy is one of the latest subjects which we should study and one in whose pursuit we can profitably employ all that we have ever learned.

A second cause of difficulty is the difference of opinion among philosophers regarding the nature of their science. To the beginner this disagreement cannot fail to be confusing and incomprehensible; but, as every other fact, it too is really full of meaning if only we examine it with insight. It means that all the world grows slowly in matters philosophical, and that men are more liable to be old fashioned in their philosophical opinions than in their other beliefs. Again, it means that men are liable to be one-sided, narrow-minded, or prejudiced when it comes to taking a profound and a broad view of the world and of their life in the world; for our particular and special interests are attended to so much more frequently and seem so much more important, that our judgment is already biased when we come to the problems

which are world wide. Let us then comfort ourselves that the very difficulty of defining philosophy but shows how great is our need to study philosophy. We need to study it in order to become intellectually mature, in order to become modern, broad-minded, wide-awake, and alive to all the fundamental interests of mankind.

3. *Popular philosophy.*—The easiest means of gaining a clear idea of the nature of philosophy is to notice that every normal person is already something of a philosopher and then to consider the problems and opinions which make him a philosopher. One of these opinions is, Everything has a cause. The child asks over and over again, Why this? why that? who made this? who did that? Again, children often ask, Who made the world? How big is the world? How old is the world? From which it appears that even to them the world stretches on into distant space and time, yet constitutes a totality, and as a totality, calls for explanation. Further, the bright child soon outgrows its belief in fairies and magic. This indicates how quickly we become at least dimly aware that order and uniformity reign everywhere. It is remarkable too how early we begin to distinguish the subjective from the objective, or the mental from the externally real. Dreams soon seem unreal or rather subjective, our thoughts and feelings are soon discovered to be peculiarly our own, and in general we begin to make the great division between things mental and things non-mental, between minds and material things. Many other important general divisions are made by all men: between the living and the lifeless, between things that endure and things that quickly perish or vanish, be-

tween things and their qualities, between growth and decay, between characteristics true of a few things and those true of almost everything, between good deeds and bad deeds, between beautiful things and ugly things. Let us formulate *as problems* this philosophy of all civilized men.

(1) Had the world a beginning in time, will it ever come to an end? Has it a beginning in space? Is there but one world or are there many worlds? Has the world a creator or is it self-existent? (2) What are space and time? (3) Has everything a cause, or do some things come into existence without a cause? (4) Must a cause produce just the effect that it does, or are there free causes, for example, our wills, whose doings are absolutely unpredictable? What is fate? Is everything fated? Is there such a thing as chance, luck, or magic? (5) What are laws of nature, and in what sense do things obey these laws? (6) What is a thing? What is a quality? (7) Are there things which never arise or pass away, that are eternal? (8) What features, aspects or attributes of the things in the world about us are eternal? Or is nothing eternal or changeless? (9) What are change, growth and decay? (10) What is the difference between minds and things that are not minds? How does our mind inhabit the body, and determine its conduct? How does our body influence the mind? Is there such a thing as the soul? Is it immortal? (11) What is life? Is the living radically different from the lifeless? (12) What makes one deed good and another bad? (13) What is it in one thing that makes it beautiful and in another that makes it ugly; in other words, what

is the nature of beauty? (14) Is there a God? How can we know that there is? How are we to picture or to conceive Him? What is His relation to the world? (15) Can we be absolutely certain about anything we know? Or is all knowledge at best probability? What parts of our knowledge come nearest to certainty or are certain? What is truth? (16) Why are we so confident about the propositions of arithmetic and geometry and so little confident about many other things, such as to-morrow's weather? These problems are philosophical. What then is the nature of philosophy?

4. The definition of philosophy.—(1) Philosophy points out the notions which turn up so often in our thinking and which seem indispensable to our thinking, for example, cause, thing, space and time, good, knowledge, true. (2) Philosophy endeavors to define these notions with utmost precision. (3) Philosophy tries to ascertain the fundamental truths regarding the world and the things and events which constitute it. By a fundamental truth I mean a truth that seems to be an *indispensable* part of *our way of thinking*. Thus we seek the *cause* of this or that event and thereby presuppose that events must have a cause; we try to discover what happened millions of years ago, thereby presupposing that there was such a time; we investigate the *origin* of things and thereby presuppose that all or most things have an origin; we say that we are certain about some matters and doubtful about others, and thereby presuppose that parts of our knowledge are better founded than other parts, and that some parts are surely true. (4) Philosophy endeavors to answer the most general questions we can ask

regarding the world and the things within it. Is there only one world? Did the world have a beginning in time? Are there things which are eternal or changeless such as the ultimate parts of matter? Is all nature under the universal reign of law, or is there truly such a thing as chance?

These four points regarding philosophy may be brought together under two headings provided we understand the meaning of three very useful terms, "logically fundamental," "indefinable" and "indemonstrable." By "logically fundamental" is meant whatever *must be true* in order that other things can be true, or whatever must be understood in order that other things can be understood. Thus if the sum of the angles of a plane triangle equals two right angles, it must be true that the whole equals the sum of its parts. If there can be a perpetual motion machine, it must be true that friction can be totally eliminated. That is, whatever is an indispensable premise of any conclusion is logically more nearly fundamental; and if so, some truths must be genuinely fundamental. If C must be true that D may be true and if B must be true that C may be true, evidently we shall come in time to a beginning, a proposition which must be true that others may be true but which we cannot demonstrate. Such a proposition is an "indemonstrable." In short, an indemonstrable is a proposition which is genuinely a first premise. Some of the laws of logic must be indemonstrables for we use them in proving and should have to use them as premises in order to prove them true. Again, to understand what a triangle is we must understand what a plane figure is; to understand what coal is, we

must understand what carbon is; to understand what theft is, we must understand what property is. In short, one notion is logically fundamental to another provided it is indispensable in defining that other. If C enables us to define D, and B is required to define C and A to define B; we must come sooner or later to the end of the line where we cannot define without "a circle in the definition." If A is the ultimate, not only is it logically fundamental to B, C, and D, but it is an "indefinable." We are now ready for the briefer statement of the nature of philosophy. (1) *Philosophy seeks the logically fundamental, that is, the indefinables and the indemonstrables of all our knowledge.* (2) *Philosophy endeavors to formulate the highest generalizations warranted by the sum total of information man possesses.*

In seeking the former, philosophy may be called *The Study of the Logical Foundations of Knowledge.* In endeavoring to do the latter, it may be called *The Unification of Knowledge.* This last name is quite appropriate because as man discovers laws of higher and higher generality, the sciences tend to merge into one another and to raise even the question whether or not all sciences are not really parts of one universal science. If they are one science, that science is philosophy. For example, every student of zoölogy and botany knows that many truths hold of all forms of life and that this large body of information regarding all life is a sort of trunk science of which botany and zoölogy are branches. Some call it biology. Again, every student of chemistry and physics knows that many truths are common to both sciences; and the question has often been raised, may not chemis-

try some day in the distant future be explicitly a branch of physics? Indeed there are hardly any two sciences which have not many truths in common, that do not turn out to have more and more in common as our knowledge increases, and that do not thereby suggest one tree of knowledge of which all sciences are branches. We have now our definition of philosophy. (1) Philosophy is the science of the logical foundations of all knowledge. It is the First (logically) Science. (2) Again, Philosophy is the highest generalizations which scientific research thus far warrants or suggests. It consists of the great unifying truths and as such is, The Science of Sciences.

5. *Metaphysics defined.*—I have said that within philosophy this book will be confined to a part called metaphysics. What is metaphysics? We can now find the answer quickly and easily. Philosophy, as just defined, has to do with *all* knowledge. Metaphysics has to do with only *a part* of knowledge. Philosophy includes not merely the knowledge revealed in mathematics, chemistry and biology but also the study of the good, the beautiful, and anything else that can be called true. Briefly put, man endeavors to know not only what is, but what ought to be; not only what exists, has existed, or will exist, but what ought to exist and what is in any way truly desirable. More briefly still, we seek to know the Real and the Ideal. Sometimes we limit the word science to denote the former study. In any case metaphysics is the philosophy of the real; and other divisions, such as ethics and esthetics, constitute the philosophy of the ideal. Hence we may define metaphysics as follows, remembering of course our definition of philoso-

phy: Metaphysics is (1) the study of the logical foundations of science, or of the real; (2) the theory of reality, or the highest generalizations regarding the real warranted by our present knowledge. As the former it is the First Science (science used in the narrow sense or the study of the real). As the latter, it is The Theory of Reality.

6. The program of this book.—Within metaphysics we shall confine our study to the former, the logical foundations of man's knowledge of the real world. Accordingly, we shall have to seek the fundamental notions in terms of which man is and has been endeavoring to interpret reality. When found, we should try either to define these notions rigorously or to admit that they remain still undefined. Again, we shall have to seek the fundamental premises upon which the scientific convictions of the present and of past ages rest logically, especially those ultimate premises, the indemonstrables. But to do even this fully and rigorously would be a vast and a most difficult enterprise and would far outstrip the ambitions and purposes of an elementary book. Consequently we shall seek not a detailed and exhaustive knowledge of this field of metaphysics but only a bird's-eye view, a general outlook, enough to make us feel acquainted and somewhat at home. Our study will be divided into three parts. The first part will be introductory leading to the answer of the question, What do we mean by the words science, reality, and universe? The second part will introduce the student to certain fundamental metaphysical hypotheses. Some of these will have been deliberately avoided in the first part and others will have been intentionally ruled out as false

by the very definitions which the first part formulates. This part will acquaint the student also with the foundations of man's older theory of reality, which I entitle, The Substance Hypothesis, and with a more recent theory of reality, a theory widely entertained by the thinkers of the past two hundred years, The Idealistic Hypothesis. The last part will give a brief sketch of some of the more prominent metaphysical hypotheses found within the special sciences.

FOR FURTHER STUDY READ:

Paulsen, Introduction to Philosophy, 1–50;
Butler, N. M. Philosophy;
Windelband, History of Philosophy, 1–8;
Woodbridge, Metaphysics (in Lectures on Science, Philosophy and Art, Columbia University Press);
Sidgwick, Philosophy, Its Scope and Relations, 1–75, 76–121.

FOR MORE EXTENSIVE STUDY READ:

Sidgwick, Philosophy, Its Scope and Relations.

PART II

THE NATURE OF SCIENCE

In this part I shall define a number of fundamental terms and point out several indefinables. These terms are:—Information, Term, Relation, Truth, Implication, Proposition, Postulate, Fact, Theory, Explanation, Existence, World, Science, Faith, Value. This list of words sounds at first formidable: but it will prove to be a very important list; for to see clearly what these words mean is to gain a profound insight into our knowledge of things and is to secure far greater rigor and definiteness in our thinking. Hence, though these words sound uninteresting, a careful study of them will more than repay us for the time and labor required.

CHAPTER III

THE NATURE OF THAT WHICH IS KNOWN

1. *The nature of information.*—What, precisely, is information? "Whatever we know." But what do we know, or better, what as such is knowable? How does the presence of information differ directly from the absence of information? The answer is: Whenever we know, we are aware of some relation between one entity and another. Thus I know that this is the sixteenth day of October, that is, I am aware of a relation between to-day and the other days in the system we call the calendar. I notice that Mr. E. is on my right hand and Mr. F. on my left hand and that Mr. G. stands behind them. In all these cases evidently I know relations between things. Further, we know that whales are mammals, that the anopheles mosquito is a carrier of the malaria parasite, that Napoleon was a Corsican, in other words, that one class of objects is included in another class of objects or that one object is a member of a given class. Here, likewise, we know relations between terms. We know also that things are related as cause and effect. For example, we learn that the wind causes the waves, that the volume and pressure of a gas are functions of one another. Again, all sorts of comparisons of one object with another by means of some standard of measurement lead to information, such as, A is more beautiful than B, C is hotter than D,

F is heavier than G, L is longer than M, Mr. R. is older, richer and wiser than Mr. S. Finally, mathematics gives us most explicitly information regarding certain relations between terms, thus $(a+b)^2=a^2+2ab+b^2$.

There are cases where this relationship between terms is not so apparent, such cases as: this flag is red; the dog runs; the house is building; the load is carried; the comet was seen; the race was run; the jar was broken. But in these and similar instances analysis reveals either a complex of relations and several terms or some conventional and fairly definite type of relation, as, for example, the relation between a thing and its quality, between a thing and its acts, or again the relation between a thing and changes in its quality or in some of its relations brought about by an outside agent. In most of these cases a fairly simple statement verbally may convey a most complex bit of information: as, the building was torn down; the machine was put together; the child is growing. Of course, precisely what our words mean to us and to our audience will depend largely upon what we and they know about the matter involved. The important point is, however, that if that information is carefully analyzed, it will be found to be made up of bits of information and these bits of information will in their turn prove to be relations between terms. Hence the information in my mind "my house is building" is probably equivalent to a long list of simpler bits of information, such as "the bricks and other pieces of material are being placed in this, that and the other special relation to one another," "the hands, arms, and legs of the artisans go through certain motions with certain

mechanical effects," "many conversations take place between me and the builder and architect," and so on indefinitely. In any case all information will prove to be simple or complex systems of terms in relation.

It may seem to the reader that information might sometimes be merely terms, as when I see merely a bright light, or hear merely a strange noise, or behold merely some thing quite new to me. But to see a thing is not to know a thing. A baby may see a watch and know nothing. You and I see it and know it to be a complicated mechanism. The child merely gets certain sensations of color and sound, possibly without any awareness of relationship whatsoever. Of course, merely to notice "the colored object connected with ticking" would be to know something but it would be a perception of relation. Prof. James expressed this point well in his distinction between "acquaintance with" and "knowledge about." A brute may be acquainted with things, that is, may get sensations from them, but know nothing about them. Such must be the state of affairs as the cat "hears" the conversation in the home, or the dog "watches" us write a letter. In short, if all awareness of relation is lacking, whatever we may rightly be said to have, we cannot be said to have information.

2. *The nature of truth.*—There is a further characteristic essential to information:—*it must be true or false.* Indeed, it is the only thing in all the world which is one or the other, and conversely whatever is either true or false must be information. Hence, if a man tells us he knows something, he means at least that he believes something to be a truth. Here we introduce a word,

and a very important word, without having defined it; for, what is truth?[1] Unfortunately this seems to be a question which it is impossible to answer. As has been stated, some notions are so nearly ultimate that when you try to define them you find that you have no notions more nearly fundamental by means of which the defining can be done. In this case you will, if you proceed, run into what logic calls a circular definition, for you will use notion x to define y and then when you define x, you will have to do so in terms of y. Thus in the foregoing section we did not define "term" or "relation." A term is that which can stand in a relation, and a relation is that which can hold between terms; but this is not a definition, for each notion presupposes the other. So too, I believe that an examination of any definition of truth will reveal that the notion defined is presupposed in the definition. Of course, the fact that these terms are indefinable does not prevent our recognizing a truth or a relation when we find one; for, if it did, not only would the notion be useless but we should not have it at all.

3. *The nature of propositions.*—Though we cannot

[1] The word *truth* is ambiguous. It is used here as a property of propositions, as in the statement, "it is true that the earth revolves on its axis." It is often used as a property of our beliefs, thoughts or judgments. They are *true* when that which we think or assert is *true* (in the first sense). Those who use the word true in this second sense, use the words *real* or *fact* as the equivalent of true in the first sense. But as it is awkward to say "a real proposition" instead of "a true proposition" and as *true* so used must be one of the fundamental notions of logic, I prefer to use the word *correct* or some equivalent for true in the second sense. The words *fact* and *real* will be defined later. I use them in a different sense from that just mentioned. Truth in the second sense can be defined.

define truth, we can point out one remarkable characteristic possessed by all truths and falsehoods: they never stand alone. Always if one thing is true, another must be true or false; or, if one thing is false, some other must be true. This characteristic is called implication. It is an ultimate relation obtaining between truths and falsehoods, and is usually regarded as indefinable. Some define it by taking the notion "either-or" as indefinable and by using this notion as a basis of definition. In that case (a piece of information) x implies (another piece of information) y when *either* y is true *or* x is false. For example, if it is true that B is the son of A, it must be true that A is a parent of B. In other words, if it is not true that A is a parent of B, it cannot be true that B is the son of A. *Either* A is a parent of B *or* B is not a son of A. Notice moreover that it may be true that A is a parent of B but false that B is a son of A, for B may be a daughter. In short, X implies Y means:—if X is true, so is Y; and if Y is false, so is X; but X may be false and Y still be true. All this is summed up in the words, "if X, then Y."

All cases of argument, or demonstration, are illustrations of how one truth or falsehood "leads on" to others; and therefore *every book in mathematics or any other science is made up almost entirely of statements that one thing implies another.* For example, if two sides of a triangle are equal, their opposite angles are equal. If the volume of a gas decreases, its pressure will increase. If a body moves in empty space, it will move in a straight line with uniform velocity.

If the nature of implication is clear to us, we are ready

to define another technical term. *Whatever implies or is implied is a proposition;* which in turn means that we know already many things about propositions. If propositions imply one another they must be either truths or falsities. Moreover, if they are truths or falsities they must be information and if they are information they must consist of relationships between terms. In other words, propositions are units or bits of information, and as such they are made up of relations between terms, they are either true or false, and they imply one another.

(SECTIONS 1–3) FOR FURTHER STUDY READ:
Read, The Metaphysics of Nature, 2d ed., Chap. XIII, Pt. I;
Moore, G. E. The Nature of Judgment, *Mind*, 1899, *8*.

FOR ADVANCED STUDY READ:
Russell, Principles of Mathematics, Chap. III;
Erdmann, Logik, 2te Aufl., Bd. I, 55–258;
Sigwart, Logic, Pt. I, 23–235.

4. The knowledge of propositions.—From the foregoing definition of the term *proposition* it follows that whenever a man says, he knows a proposition, it is proper for us to ask him three questions: first, What precisely is the relationship between terms, that is, the proposition which you have before your mind? secondly, Is it true or is it false? thirdly, What does it imply? If he can answer correctly these three questions, he does indeed know that proposition. However, as is evident, he might be able to answer the first two without being able to answer the last; and again, he might be able to answer the first and the third but not the second; and finally unless he is able to answer the first he cannot answer either of the other two, for he does not know even what

he is talking about. Let me illustrate. If a patient says to me, his physician, "My wound is painful," it might be that before I can decide whether his assertion is true or false and before I can ascertain what it implies, I shall have to learn precisely what it means. Now this particular illustration is chosen because psychologists find that individuals very often disagree as to what is and what is not painful and because this disagreement can hardly be due to a man's inability to observe his own feelings. They find rather that few men mean by the word "pain" precisely the same feeling. Could we find, however, some means by which all men and our patient in particular would agree upon a standard feeling, called pain, then each could very quickly decide whether his present feeling is painful or not. Let us assume that we have been able to do this. There would still remain the question, Is our patient telling the truth or is he endeavoring to deceive us? Let us assume first that this second difficulty also has been met, and that our patient is telling the truth. There will still remain a third question, What does this truth imply? Does it imply that blood poisoning is beginning or something else? Evidently we may not know. This is a case when we may know the proposition to be true without knowing what it implies. In contrast to this let us assume that we do not know the patient to be truthful. Then we should know the meaning of the proposition and we might know also regarding its significance or what it would imply if true; but we should be in doubt as to the truthfulness of the man's statement, for we might suspect him to be a coward or a malingerer. In this case we

know the proposition and what it implies without knowing whether it is true or false.

Granting the pertinency of these questions, how shall we answer them? (1) How do we know a proposition? (2) How do we ascertain whether it is true or false? (3) How do we learn what it implies? The first question we shall answer briefly at once; the answer to the others we must postpone. Ultimately we reveal the propositions we are asserting only by pointing out what we mean or acting out what we mean; but where others are already familiar with most of our thoughts and beliefs, we can point out indirectly either by description or by definition. To a baby we point out a cow or a horse and so the child learns the meaning of these words. To a zoölogist we describe a new species and he understands. To a mathematician we offer a rigorous definition of a curve heretofore unknown to him and he may be able at once to deduce many of its further properties. But neither the zoölogist nor the mathematician could understand us unless much information were already common to him and to us. Thus to know a proposition, means to be able to point out its terms and their relation, to be able to describe them or to be able to define them; and, as we have seen, we might be able to do all this and not yet know whether the proposition is true or false.

5. *The ascertainment of truth.*—How do we ascertain whether a proposition is true or false? Three methods are actually employed although one is only a necessary makeshift. (1) *First we may simply guess at its truth or accept it tentatively.* Indeed this is what we have to do most of the time. Fortunately for us, however, our guess

is seldom wholly blind; for often though we do not know a proposition to be true, we do know it to have some chances of being true. Thus whether a tossed coin will fall heads or tails we cannot foretell with certainty; but should we have to guess, we know we have one chance in two of being correct. So throughout life we can seldom know from the beginning the final outcome of our enterprises; but as we cannot wait we have to act in the way which seems most likely to be successful, which means, we have to make the field of pure guess, or venture as small as our knowledge permits. We insure our lives though we may lose money in so doing. We choose a calling though we may afterward prove unfitted. We breathe the air of our streets though it may contain the germs which will kill us. In short, nothing risked, nothing accomplished; and this is true not merely of practical affairs but also of the sciences. All scientists have their working hypotheses; and every science is based in part upon unproved assumptions, or as we shall henceforth call them, *postulates*. The future alone can tell whether or not our present theories are true; for, as history shows, many things confidently believed in by people in bygone centuries were really false and some things we have to call mere superstitions. How will our convictions appear to men centuries from now? Well, it is not our business either to ask this question or to be concerned about the matter, but to forge ahead fearlessly as best we can.

(2) The second method by which we ascertain the truth or falsity of a proposition is *to infer it from other propositions which we know or believe to be true.* That is,

we get our information by reasoning. The most wonderful and perfect example of the successful employment of this method is the science of mathematics. In our elementary geometry we started with a few propositions which we assumed and then we deduced proposition after proposition until we acquired an extensive body of information. However, mathematics is by no means the only place where we reason; for some reasoning is to be found in almost all our intellectual processes. Indeed most psychologists believe that this ability to reason or to infer is a trait which quite marks off the human intellect from the mind of even the highest brutes; and all must agree that man's intellectual achievements would have been impossible had his learning remained solely of the trial and error type.

But our rationality has one serious shortcoming. To reason is to infer conclusions from premises, to derive the truth of one proposition from the assumed truth of another. How then do we know that our premises themselves are true? Did we get them too by reasoning? If so, this only pushes our question back to the premises of an earlier inference, it does not give an ultimate proof. If to reason is then but to guess and afterward to infer from the proposition guessed, wherein does it give us a genuine hold on truth? The answer is, if these two were our only methods, we could not know the truth of any proposition. We might guess rightly and do so often; but we should never know when we had or even when we had not. We should be like the lowest forms of life which adapt themselves often most successfully to the objects and forces of nature surrounding them and acting upon

them, but which cannot know, as we know, either falsity or truth.

(3) The first and second methods of ascertaining truth leave a gap which is filled by the third method. Not only do we guess at truth, not only do we infer truth but also *we perceive truth.* For example, if we guess heads or tails when a coin is tossed we soon perceive whether or not we are right. If a man has a device for accomplishing some end, he can put it to the test and perceive if it will work. If a scientist has a theory, he can deduce some of its consequences and put them to a crucial test in his laboratory and perceive if his theory is false. Thus day by day we are putting our beliefs and plans to the test of perception. If they agree with what we perceive or if they work, we are confirmed in our intellectual venture. If they do not agree with what we perceive or if we perceive that they do not work, we tend to discard them and should discard them for new beliefs and new plans. Perception then gives us our ultimate warrant. It tells us when we are right and when we are wrong. It tells us that some things are thus and that other things are not. In short, it tells us all that we *know* to be true.

This enables us to give a technical meaning to a familiar word. Henceforth we shall always mean by the word *fact*, a perceived truth. Fact then is opposed to *theory*, for theory is always either a guess, or an inference in part from guesses. Facts are as such true. Theories on the other hand are sometimes true, sometimes false. This is what we mean when we say a theory should conform to the facts and if it does not, the theory must give place to another.

(SECTIONS 4 AND 5) FOR FURTHER STUDY READ:

Mill, Logic, Bk. III, Chap. VII; Bk. IV, Chap. I;
Venn, Empirical Logic, Chaps. I, XIV, XXI;
Tyndall, Fragments of Science, "The Scientific Use of the Imagination;"
Clifford, Lectures and Essays, "On the Aims and Achievements of Scientific Thought;"
Mach, Popular Scientific Lectures, "On the Part Played by Accident in Invention and Discovery;"
Aikins, Principles of Logic, Chaps. XXXIII–XXXVI;
Marvin, Introduction to Systematic Philosophy, 349–373, 412–419;
Hobhouse, Theory of Knowledge, 15–59;
Russell, The Problems of Philosophy, Chaps. V and VI, XIII and XIV;
Stout, Immediacy, Mediacy and Coherence, *Mind*, 1908, *17*.

FOR MORE EXTENSIVE STUDY READ:

Locke, Essay Concerning Human Understanding, Bk. IV, Chaps. I–VI;
Russell, The Problems of Philosophy;
Schmidt, Critique of Cognition and its Principles, *J. of Philos., Psychol., etc.*, 1909, *6;*
Jevons, Principles of Science, Bk. IV;
Sigwart, Logic, Pt. II, 295–325; and Pt. III.

FOR ADVANCED STUDY READ:

Hobhouse, Theory of Knowledge.

6. The nature of explanation.—This in turn enables us to define precisely another familiar word, namely, *explanation.* What do we do when we explain? *We discover a premise or set of premises from which a given fact or facts follow, or can be deduced.* For example, I hear a strange noise on the hearth, and after listening attentively I decide it is made by a cricket. That is, "if a cricket is on the hearth, it would follow that we

should hear such a sound." The noise is my fact; that a cricket is on the hearth, is the premise I have assumed to account for, or to explain, this fact. If this fact follows from my premise and from no other premise which I may have overlooked, then no doubt I have discovered the correct explanation. As another example we might take the undulatory theory of light. No one has actually seen the ether or its undulations. These undulations then are not a fact but a theory, and as a theory their whole significance is that they agree with other theories which we hold and that their assumption gives us premises from which the facts of light can be deduced. The same is true even of the proposition, the earth is a sphere. Nobody has seen this sphere; yet since so very many facts can be deduced from the assumption and since no known fact disagrees with it, he who would question it to-day, would be considered insane. Still it is only an explanation; and there is no other reason to regard it as true, except that it does explain.

FOR FURTHER STUDY READ:

Mill, Logic, Bk. III, Chaps. XI–XIV;
Hobhouse, Theory of Knowledge, 442–474;
Joseph, Introduction to Logic, Chap. XXIII.
Nunn, On Causal Explanation, *Proc. Aristotel. Soc.*, 1906–7, 7.

FOR MORE EXTENSIVE STUDY READ:

Russell, The Problems of Philosophy;
Smith, Norman, Studies in the Cartesian Philosophy, Chap. II;
Descartes, Discourse on Method;
Descartes, Regulæ ad Directionem Ingenii.

FOR ADVANCED STUDY READ:

Nunn, Aim and Achievements of Scientific Method.

7. *The world.*—Having learned to distinguish between facts, or what we perceive, and their explanation, we can define the term, *world. The word "world" or "universe" is the name for the true and complete explanation of all facts.* As an illustration, let us assume that the solar system, as studied in astronomy, is the whole world. Now the solar system is the theory which astronomy offers in explanation of a multitude of facts or perceived truths. These truths include the rising and setting of the sun, moon, and stars, the succession of day and night, summer and winter, the elevation of the sun in the heavens, the erratic motion of the planets, the phases of the moon, the eclipses of both sun and moon, as well as countless other facts. Notice that "the solar system" is indeed a theory, or explanation. Nobody ever perceived the earth revolve, or the planets go about the sun in their orbits, or even the earth itself as a sphere. The only warrant for believing these propositions is that *they explain so well what we do perceive.* We do perceive the sunset, the phases of the moon, and so these are not theory but fact; but the solar system is not only a theory, a theory with a history, but one among other conceivable or rival theories. Before 1600 A. D. men believed in a very different theory, which made the earth the immovable centre of the universe with the sun revolving about it; and if now we have full confidence in our present heliocentric theory, this is simply because all rival theories have proved false, inadequate, or inconvenient, and because this theory agrees with all perceptual tests to date. Notice, moreover, that our complete confidence in this theory expresses itself in the assertion that the solar

system *exists*. Yet, since nobody has ever perceived "the solar system," this assertion, analyzed logically, is no more than the assertion "the solar system" explains and alone explains what we perceive.

If the perceived did not raise problems or call for explanation, if we could accept it not only as it is given but as all that is true; then we should have no world. We should live, as do the lowest brutes, from moment to moment, reacting blindly now to this sensation and now to that; but we should never assert existence. But the perceived does raise problems in our minds; and so man, from childhood to the grave, from prehistoric days to the present, has been seeking and discovering their solution. As he does so, the world as conceived by him keeps growing and changing, and must continue to do so until the true and full explanation is found of all that he perceives. Of this perfect explanation most people believe we have already a part; but how much there remains to add and how many truths remain to be perceived, is a question no one can answer. However we can define the world. The universe, or world is *a theory*. It is a theory in answer to questions which in their origin are always regarding the perceptual. To repeat, it is the complete explanation of all fact.

The word "all" must be emphasized. The world is the complete explanation of *all* facts. All facts include not only those man has perceived or does perceive, but will perceive, or can perceive, or should perceive. They include all perceivable truth. Again, they include not merely the truths our eyes perceive in the field or laboratory or through the telescope, but also the truths

that the moralist, the artist, the religious perceive. They include, then, all facts whose explanation we seek from science in the very broadest sense of this word.

8. Existence.—Finally, in defining the term "world" we have at the same time been defining the term "to exist." Whatever belongs to the world, or is a part or aspect of the world, exists. Otherwise expressed, whatever explains or in part explains any fact and is consistent with all other facts and their explanation, is rightly said to exist. Thus, hearing many unfamiliar noises at night, the superstitious man may say, "A ghost is moving about the house." This is his explanation of a perceived truth, the noises; and accordingly he asserts the ghost's existence. But should he inform himself of further perceivable truth, there is little doubt that he would reject his old hypothesis and entertain a quite different one. However, what is true of the superstitious is in part true of all men. In the light of our knowledge or the darkness of our ignorance we explain what we perceive and then assert existence. In so doing we are presupposing some world hypothesis or another, perhaps a crude and primitive one or perhaps one of a modern and an enlightened adult. Moreover, we fit the thing which we assert to exist somehow into this world conception and into the system of other existents in which we believe. As long as we feel satisfied with the result we do not question the thing's existence; but should the clash be too severe for our intellectual conscience we have to give up either the old or the new and offer ourselves some other hypothesis. Thus the highway of man's intellectual progress from savagedom to the

civilization of to-day is lined on both sides with discarded "existents." They perished because the logical load they were carrying was too much for them or because stronger carriers were found to take their place. Therefore, whenever we say anything exists we are merely offering our present explanation of some fact or other.

(SECTIONS 7 AND 8) FOR FURTHER STUDY READ:

Marvin, The Existential Proposition, *J. of Philos., Psychol., etc.*, 1911, *8;*

Hume, Enquiry concerning Human Understanding, Sect. IV.

CHAPTER IV

EVERYMAN'S THEORY OF REALITY

1. *Introduction.*—The "world" or "universe" has been defined as "the true and complete explanation of what we perceive." This definition is our most important result thus far. Through it we learn that the world as thought or conceived by each man depends upon two things:—first, upon what he has perceived; secondly, upon his success in explaining what he has perceived. As men differ greatly in both these respects, they differ also in the way in which they think or conceive the world. The world of the child is far different from the world of the adult, and the world of the savage or of the peasant is markedly unlike that of the scientist. Moreover, men differ in their way of conceiving the world not only as individuals but also as social groups and as members of this or that historical period. The world as conceived by the oriental is different from the world as conceived by the man of western Europe. The world of modern science is extremely unlike the world of even the most learned men of the thirteenth century.

Great as are these differences and great as may be the differences in the future which the advance of knowledge may bring about, still all ages and all individuals have been engaged upon a common task and all have contributed something to its fulfillment. Our ways of conceiving the world may be different, and the facts known to us

may be different; still one common problem faces us all: What is the true and complete explanation of that which is perceived? Moreover, different as are our worlds, all men have some results in common; for the lowest savage and the normal child are not so foreign to civilized man's ways of thinking that he cannot communicate with them. In other words, his world is not a separate world from theirs. Not only has the world as conceived by the modern scientist and philosopher grown out of the world as conceived by the child and by the ancient; but it has remained in parts virtually unchanged. Indeed, logically behind or beneath science stands the world of everyman, the world of the learned and of the ignorant, the world of the ancient and of the modern. We might call it the world of common sense.

The purpose of this chapter will be to show that this world of everyman, or of common sense, is already an elaborate and complicated explanation of what we perceive, and that it should never be confused by the metaphysician with the perceived.

2. *The world as perceived.*—The ordinary adult is an old fogy biased and set in his ways of explaining and perceiving facts. The cause of this bias is that he has become habituated to the explanations of these facts which have been taught him from childhood and that he fuses the facts and the explanations so thoroughly that he seldom distinguishes between them. But as students of metaphysics we must now do so.

First, let us imagine ourselves on the platform of a railway station watching an approaching train. As we look at the locomotive, it keeps getting bigger and

bigger slowly at first, then more and more rapidly as it draws near. As adults we say, the locomotive has not changed in size but a mile away was *really* as large as here twenty feet away; yet perception says, it grew larger and larger. We board the train and it is soon under way. We look through the windows. Objects are flying by, those "near us" very rapidly, those "farther away" less rapidly. Looking through the rear window of the last car, we see that the rails in the distance meet at a point and form the two sides of an extremely elongated triangle. Near by, the sides of this triangle are rapidly receding and at the same time moving rapidly together. Finally we notice that the "distant" objects, men, animals, trees, houses, mountains, are small; the "near ones" much larger. All this is what perception says; but common sense gives a very different account.

Secondly, let us imagine ourselves walking along a city street. As we look down the street the buildings are in "perspective," the street grows narrower in the distance as did the rails, the lines of windows and roofs descend and meet the distant horizon. As we pass a building, if we watch sharply, we shall see that it is changing its shape. As we look at this or that person approaching, we shall see him not only increasing in size, but also changing in many other respects. His clothing increases in detail. The details of its coloring and its shape, of its pattern and its parts grow, literally spring into existence. Likewise his face takes on features and expression. To make a long story short, let us recall the following few out of many familiar yet remarkable percepts. A "straight" stick partly immersed in water

looks bent. Sometimes "tepid" water feels to one hand hot, to the other cold. The crater of an extracted tooth is much bigger according to the testimony of the tip of the tongue than it is according to that of the end of the finger. A warm radiator is warmer when felt by the back of the hand than when felt by the palm.

To make clearer this picture of things *as perceived* let us add to the list some things which we do *not* perceive. No one ever saw the earth, that is, the planet, but only parts of its surface. No one ever perceived the earth turn on its axis. No one ever saw a thousand miles of railroad, even if he has tramped twenty thousand on that highway. We are told that the sun is 90,000,000 miles away, but when you look at the sun you do not seem to see between you and it a space of that diameter. Similarly in the case of time, we never perceive as long a span as five minutes, and a year is as truly an impossible percept as is infinite space. Finally, to come nearer to what we do perceive, no one ever saw Westminster Abbey or his own house. You have seen the west side of your house, but when you were looking at this you did not see the east side. Again, if your house has many rooms and two or more stories, you have seen now this room and now that, but the "house," that is, all the rooms, windows, doors, walls, front, side and rear elevations: all these and all in their correct geometrical and metrical relations one to another, you have never seen. It is evident too that a man has never perceived his own body, that is, the body as fully described in the ponderous volumes on human anatomy.

But enough said. It is evident that the world, or mani-

fold, perceived by you and me is very different from the world we ordinarily think about. The perceived world is spatially a small world. It is a world of a moment. In it men, houses and locomotives change their shape, size, and color. Walk across the room and your table changes its shape and size and probably color! Hold your hand close to your eyes and the hand becomes as big as the room!

FOR FURTHER STUDY READ:
Santayana, Life of Reason, I, 35–291;
Berkeley, Essay Towards a New Theory of Vision;
Clifford, Lectures and Essays, "The Philosophy of the Pure Sciences," I, Statement of the Question;
Pearson, Grammar of Science, Chap. VI.

3. *The world of common sense.*—In contrast to this perceived world consider the world as ordinarily conceived, the world of common sense. In this world objects are stationary and do not fly by the windows of the moving train. The rails are parallel and motionless. The men and trees and houses at a distance are no smaller than those near by. The size of the locomotive is constant and does not alter as the locomotive approaches. The straight stick immersed in the water remains straight. Houses do not alter their shape as we pass, for their shape is constant. The street and houses are not in perspective. Their lines are parallel. The crater of the extracted tooth does not change its size nor the radiator its heat under the conditions aforegiven. Though we may not perceive "the house," what we do perceive is part of a real house of such and such dimensions, parts, number of rooms, and materials. And of course a man's hand

is never as big as the room, and the furniture does not alter its shape, size and color as we walk up and down the room.

Now, every student of psychology knows that this world of common sense is not known by the very young child. To it, a distant man or house *is* small; the moon does race through the clouds; the sun does rise and set. As for the earth being a globe and revolving on its axis, that is a fantastic, incomprehensible way in which grown people talk. It requires years of training for the child to learn the truths of common sense; and this shows that the world as believed in by common sense or as thought of in daily life, instead of being a perceived world, is a most elaborate and wonderful *world hypothesis*. It is not perceived but conceived; and the way in which we adults conceive it has not only grown but has grown continuously from babyhood to our present state. Of course it has developed under the control of our percepts. It has grown out of our percepts. It has been constantly tested and corrected by our percepts. Yet it is not the world we actually perceive, and in many respects it is radically different from what we do perceive. The two worlds, or systems of terms and relations, are not only different in character but are numerically different. They cannot be logically identified, though they are connected logically and most intimately. To sum up: *The world of common sense is man's first great world hypothesis; it is not a world of perceived fact, rather it is a* THEORY, *no matter how well established a theory.*

Out of this theory, which we call the world of common sense, science has grown; and though science has gradu-

ally reconstructed it, science never totally rejects it, and seldom ceases to be logically dependent upon it. As a consequence, the metaphysics of common sense is important not only in and by itself, but also for its influence upon science and because of its presence within science. Indeed, where science has outgrown the metaphysics of common sense, it has done so very gradually and often not thoroughly. All of this will become apparent as we proceed.

FOR FURTHER STUDY READ:
Russell, The Problems of Philosophy, Chaps. I and II.

FOR ADVANCED STUDY READ:
Nunn, Aim and Achievements of Scientific Method, Chaps. I and II.

4. Appearance and reality.—The study of the relation of the world as perceived to the world of common sense introduces us to one of the most vexed questions in metaphysics. This question is, what is the place in reality occupied by the world of perception? A later chapter will give part of the answer to this question, but the fundamental point at issue may be taken up at once. If to explain my perceptions of my desk I assert a rectangular desk of a standard size, if to explain my perceptions of the oncoming locomotive I assert a locomotive of constant size; what relation obtains between the observed facts and the theoretical entity, do both belong to reality? Most metaphysicians reply, "the many unlike and changing data of perception are not real but are appearance, whereas the standard object in whose existence we come to believe is the genuinely real."

That is, the oncoming locomotive which I see is not real. The real locomotive is constant in size. Thus the relation between the two is said to be that of a reality and of its appearance. The objection to this answer is that it is false to the data in question and that it clears up no difficulties.

As we have found, the relation between the world as perceived and the world as conceived is that of fact and its explanation. Moreover, *that is all there is to the problem.* The conceived rectangular changeless desk is a theory, and the only reason for asserting its existence is that it explains the desk I do perceive. With it as a premise I am able to infer many of the properties of the desk I perceive and I am able to do this far more readily than did I use any particular percept as my premise. I can give instructions to a cabinet maker to make me another desk much more easily and intelligibly if I present him with rectangular plans than if I give him a photograph of the desk. A similar truth holds of the plans of a house given to the builder. In short, theory is a far better guide to conduct than are photographs or isolated percepts. All this, however, does not make the conceptual desk real and the perceived desk mere appearance. Both are real.

It will here be objected, "A desk cannot change in size and shape and at the same time be constant. Do you mean that there are two real desks and not merely two but a hundred, for as you go about the room you could easily get a hundred different photographs of your desk?" This question reveals much confusion in the mind of the questioner. There is not one desk in

the sense that several different photographs are identical or duplicate pictures. If a man has several different photographs taken of himself in quite different positions evidently they are not the same picture. If they were, why should he not be satisfied with one? In this sense there are indeed thousands of desks in my study, and you and I are thousands of different individuals. But this is not what we mean when we say all are one desk or all are one man. We mean that the various data are parts or members of one system intimately and logically related. So much so that the system stands quite distinct from other systems and forms what we call a thing.

That a thing should have many different properties in its different relations to the world about it, should not take us by surprise. A bag of coffee on the earth may weigh a pound and on the moon but a small fraction of a pound. A bell in the air may have a sound and in a vacuum no sound. So a desk in one set of relations, the relations in which I perceive it, may be markedly different from the desk in the relations in which you perceive it and from the desk as we both conceive it. We should not call the bag of coffee and the bell two bags and two bells but one bag and one bell; and there is no more reason for calling the desk conceived and the desk perceived two desks.

Similar arguments might be made regarding all other cases where the object of theory and the object of perception differ. The heat of the fire, the color of the ocean, the sound of a whistle are different as our point of perception is different; whereas the theoretical object may have constant properties. The confusion here as

in the foregoing cases all comes from not understanding the true relation between the perceived and the conceived and the sense in which the two are the same object. To repeat: the relation is a logical relation which brings them into an identical logical system. The relation is not literal identity which of course leads to the absurdity felt by the puzzled metaphysician. The conceptual is a premise from which together with other premises (in many cases the particular spatial relations) the perceived object can be deduced. From such premises, for example, an artist could deduce a ship as perceived from a given distance and at a given angle and paint the picture of this object. From his plans and other premises an architect can deduce many of the aspects of a building and foretell their harmony and beauty.

Thus the relation between the conceived object and the perceived object is not that between a real object and its appearances but that between a premise and a conclusion. In practical affairs the conceived object is a more useful guide to our conduct and to the conduct of those whom we instruct. This, and this chiefly, leads so many to regard it as the more genuinely real. Again, the world is so much simpler if we think of objects only as we conceive them, if we ignore the many and varying aspects of the perceived. This too impels us to sacrifice truth to convenience. Habit completes the work and soon we cannot believe what we perceive. Moreover, there is no contradiction in maintaining the reality of both the perceived and the conceived. There is no contradiction in saying that the changing locomotive is also constant, as there is none in saying that two photographs taken of

a man from different positions are pictures of the same man. There is no contradiction, because the same thing can have radically different properties in different relations.[1]

FOR FURTHER STUDY READ:

Moore, Nature and Reality of Objects of Perception, *Proc. Aristotel. Soc.*, 1905–6, *6;*

Stout, Primary and Secondary Qualities, *Proc. Aristotel. Soc.*, 1903–4, *4;*

Nunn, Are Secondary Qualities Independent of Perception? *Proc. Aristotel. Soc.*, 1909–10, *10.*

FOR MORE EXTENSIVE STUDY:

Cf. references, Chapter XVI.

[1] These relations are often complicated and puzzling; and this sometimes leads us into errors, especially the errors called illusions. But these errors do not lie in the perceived entity but in the assertion of the wrong theory, or conceived entity.

CHAPTER V

THE NATURE OF SCIENCE

1. *The nature of science.*—We are now prepared to state precisely the nature of science. *Science is the explicit and demonstrated explanation of all facts.* That is, the business of scientific research is to explain all facts, to make this explanation logically explicit, and to demonstrate rigorously its truth. But science thus defined is evidently an ideal; for to demonstrate any theory requires not only sufficient premises but also knowledge of the truth of these premises. Indeed such a demonstration is a task that has nowhere been accomplished, except perhaps in formal logic and in mathematics. Still, our definition is justified; for as our sciences progress they draw nearer to this ideal. In all their stages, the sciences differentiate themselves from the knowledge and opinions of daily life, from the opinions of the ignorant and of the careless, of the child and of the savage, precisely in these respects, a rigorous demonstration is explicitly sought and methods are employed which tend to eliminate all unproved or unwarranted premises. Our ordinary knowledge and opinions are dependent to a great degree upon our instincts, our emotions, our traditions, our habits, and many another unconscious prejudice; whereas in science the struggle is to make everything logically explicit, to eliminate prejudice of all sorts, to distinguish between the certain and the probable,

and between the probable and the mere tentative guess.

However, science arises out of the humbler form of knowledge, and the psychological laws which govern the growth of the two are fundamentally the same. As trial and accidental success sometimes enable an animal to escape from a trap or to acquire a valuable habit, so also in the realm of science does the constant experimenting—as we invent and think out our theories and as we test these theories in nature and in the laboratory—enable us to discover and to demonstrate. In short, the tentative trial is never wholly lacking even in the advanced stages of a science and demonstration is never totally lacking in the ordinary beginnings of knowledge. So science and common sense are not opposites, rather they are different stages of the same process.

FOR FURTHER STUDY READ:
Santayana, Life of Reason, V, Reason in Science;
Thomson, J. A., Introduction to Science, Chaps. I–IV;
Pearson, Grammar of Science, Chap. I.

FOR ADVANCED STUDY READ:
Aristotle, Posterior Analytics;
Jevons, The Principles of Science.

2. Faith.—The true logical opposite of science is not a lower or less thorough knowledge; it is rather an explicit disobedience of the maxim that whatever is asserted as true, should be perceived or demonstrated. In other words, science is the opposite of unfounded assertion, and let us call unfounded assertion faith or belief. To believe, is not merely to entertain a proposition tentatively while we wait for evidence or while we put our

assertion to the test of experiment, nor is it to assert a proposition as probable because it will, if true, explain certain facts, nor is it to deduce a proposition from theories we know to be true. On the contrary, to believe or to have faith is to assert that which lacks proof. It is unfounded conviction.

Faith can be utterly lawless, believing even what is known to be false or denying what is known to be true; but faith is not necessarily lawless. Faith is lawless if the proposition believed might have been proved or disproved. In order not to be lawless, faith must be a belief in a proposition which for the time being lies beyond our means of verification. Moreover, since we can ignore altogether such propositions, confining our assertion to those propositions for which we have proof; faith, in order not to be lawless, must be a duty, an obligation, and not a mere impulse or act of indolence. In short, it must be shown to be genuinely valuable and more valuable than its opposite, the refusal to believe. Finally, what is not possible for us to demonstrate to-day may be possible to-morrow or the next day; therefore, to have a right to believe, we must know either that we shall never be able to prove what we believe or that we are justified in not waiting until we are able.

In other words, *faith is lawful if the proposition believed does not disagree with any other proposition which we know, if the proposition believed is not within our power to prove, and finally, if the belief is truly valuable and more valuable than its opposite, the refusal to believe, or the merely tentative assumption.*

This principle raises two important and interesting

questions. First to what extent are the convictions of the cultured man of to-day a matter of faith? Secondly, to what extent does this faith conform to the principle above given? Does man live by faith and is he justified in so doing? *Every deed in daily life involves us in acts of faith, as does every application of science.* This is so for two reasons. First, even when the deed is governed by the fullest knowledge we can command, this knowledge is always either inadequate or partly unverified. We calculate with greatest accuracy and with all but certainty the time of the rising of to-morrow's sun or the date of an eclipse; yet our astronomical theories upon which we base our calculations fall short of being completely proved. Hence even though we should be regarded insane, did we refuse to act upon this information, we are in so doing going beyond what we know to be true. If this is so in such a case, to how much greater extent do we go beyond knowledge when we decide upon a political measure or a life's career? Moreover, even when we make allowance for this lack of complete proof and act not upon the truth but upon the probability of our information, we are still acting upon faith; for the premises upon which the probability of any proposition is reckoned, always fall short of absolute certainty. When I toss a coin there are even chances of head or tail falling uppermost *provided the position of the centre of gravity does not favor either side.* But this last I may not know. Or if I do, by what means did I ascertain it? Were these means quite conclusive? So we may proceed to question indefinitely; and we shall always find that somewhere in the test we have to make

a start and so run the risk of making a false assumption. Secondly, every deed of daily life involves faith, because it is never completely tentative, it is always conclusive. We can never undo our deeds. If only we might take back our acts then we might use only tentatively the various theories or plans which we entertain; but we cannot. After the speculator in stocks has lost his fortune he cannot take his decision back and thereby recover the money and start over again. When we act, whatever may in our sight be the ultimate warrant for our action, that is absolutely asserted. Of course, if our act is blind, it asserts nothing and is morally not our act at all; but when we act conscientiously and knowingly, we always act on the basis of some conviction. This is true all the way from the answers to such questions as, Shall I take my umbrella? Shall I walk or ride? to the solutions of life's most serious problems, Shall I be a Christian? Shall I volunteer for the war? Shall I, as juryman, decide that this man is to go to the scaffold? Shall I accept the physician's advice and undergo a dangerous operation? No doubt there is much in such answers that is tentative and so not asserted, but there is always something that is asserted even if it be only the proposition, "I ought not to think over the matter any longer but to decide at once."

To go farther into this subject would lead us into ethics and the philosophy of religion. We have been led into it so far only in order to point out the difference between actual life with its absolute decisions and science with its tentative assumptions. In the life of conduct we are compelled to decide, to assert, to believe. In

the life of speculation, of theory, and of scientific research we are called upon to assert nothing for which we lack proof. Everything may be questioned, everything may be tentatively assumed, until complete proof is forthcoming. Thus theory is thoroughly radical. It may rob us of our strongest convictions and offer us nothing in their place. It may question our fondest hopes, and promise us nothing in return. For this we should not condemn it; for its work can be done in no other way, and if it compels us to outgrow our older beliefs, still, through its help, we in time reach nobler and more enlightened convictions. So far we may conclude, it is the business of science, to question old hypotheses, to invent new hypotheses, to test all hypotheses, and to demonstrate whatever it asserts.

FOR FURTHER STUDY READ:

Paulsen, Introduction to Philosophy, 313–335;
Clifford, Lectures and Essays, "The Ethics of Belief;"
James, Will to Believe, Essays "The Will to Believe," and "Is Life Worth Living;"
James, Some Problems of Philosophy, Appendix;
Russell, Philosophical Essays, 87–126;
Perry, Present Philosophical Tendencies, Chap. I;
Bradley, Faith, *Phil. Review*, 1911, *20*, 165.

3. Two ultimate types of fact.—The word science is conveniently used in a still narrower sense than that described in section 1. This narrower sense is revealed by pointing out that besides faith science has another logical opposite. *Science does not assert values;* whereas our moral and esthetic convictions do. What are values? If we examine any man's beliefs, we shall find that some

of them assert what we may call "cold-blooded truth," that is, truth which is thoroughly disinterested, whereas in other instances we shall notice evidence of personal interest, of approval or disapproval, of love or hate, of delight or sorrow, of praise or blame, of respect or indignation, of worship or disdain, of trust or dread. These latter propositions are values, and may be illustrated as follows: "He is a better man;" "You ought to go to work;" "That deed is evil;" "This sunset is beautiful;" "His cause is noble;" "God is holy and He should be worshipped." Such propositions as a group differ in some one respect from the following: "Two plus two is four;" "Water is composed of oxygen and hydrogen;" "The election was held yesterday;" "Heat caused the rail to expand;" "It is a mile from here to Oxford." These latter in no way indicate either our approval or disapproval, our admiration or disdain or any other type of valuation. No matter how properly and worthily we might wish them to be false, they are true; and we have to reconcile ourselves to this truth, even though it crush our fondest hopes. Indeed this is the lesson man has to learn, hard as it is to learn; for science in this narrower sense has in its progress found old and dear beliefs false. It has compelled man, often against his will, to change his old manner of life and adjust himself to a very different conception of the world, of man, of his origin and destiny, of his place in the universe, and of the natural laws that control his welfare. In short, science in this narrower sense is "cold-blooded" or free from judgment of value. On the other hand, let this statement not lead us to underestimate the validity of our judgments

of value. They too should become and may become thoroughly scientific in the broader sense, that is, they too are either true or false, they too are based on fact, or perceived truth, they too require to be demonstrated.

FOR FURTHER STUDY READ:
Marvin, Introduction to Systematic Philosophy, 438–448;
Russell, Philosophical Essays, 1–58;
Perry, Present Philosophical Tendencies, Chap. XIV.

FOR ADVANCED STUDY READ:
Urban, Valuation: Its Nature and Laws;
Consult for further references art. "Worth" in Baldwin's Dictionary of Philosophy and Psychology.

4. The definition of science.—We have now all the data at hand from which to formulate a complete definition of science in the narrow sense. First, science, like other types of information, consists of an array of propositions but differs from all other types in that it forms an explicit and a demonstrated system. It is knowledge and not faith. Secondly, science differs from other systems of propositions in being an explanation of facts. It is not an isolated proposition, such as the assertion, "Two plus two equals four;" rather it is the assertion, "Two plus two equals four, explains or accounts for some other truth." Thirdly, science is confined in its explanation to propositions which assert non-values: for example, science explains what exists and why it exists but does not ascertain what is valuable or why it has a value. More rigorously expressed, science does not explain the facts called values, nor does it assume premises which assert values. Hence our

complete definition: (a) *Science in the narrow sense is the explicit and demonstrated explanation of all facts that are non-values;* (b) *Science in the broad sense is the explicit and demonstrated explanation of all perceived truth.*

CHAPTER VI

THE PROGRESS OF SCIENCE

1. *The progress of science.*—Science, as defined in the previous chapter, is an ideal. It is what we hope to know and strive to know and what, in succeeding generations of men, we have come nearer to knowing; whereas what we actually know is only science in the making. However, it is convenient to call this imperfect knowledge science; but in so doing we must not confuse it with the ideal, or say of the one what is true only of the other. On the one hand, science, the ideal, does not grow. By definition it is final and perfect, and having no growth, has no history. It has been always and will be always what it is, the complete explanation of fact. On the other hand, science as we possess it, does grow, does have a history, does make progress. We speak of the history of chemistry, of physics or of astronomy. We call chemistry a young science, a science of the last one hundred and fifty years. We say that the explorers of the fifteenth century revolutionized geography, and that the investigators of the following century revolutionized astronomy and physics.

The truth, that science grows or makes progress, forces us to ask: What constitutes this progress? How does science change as it grows? How can one tell a maturer from a less mature science? Or put the question thus: You and I were once children and possessed

a child's knowledge; now we are adults and have a far better knowledge. Wherein is our present knowledge superior to that of childhood? In the first place we know more than we did in childhood, and this must mean that we know more truths. From this we may infer that science also grows by the discovery of truths. Let us call this aspect of its growth, *growth by adding information.*

In the second place we know better than we did as children because our present information is more interconnected. We have learned that this and that proposition implies or is implied by this or that other proposition. As children we know many a truth without knowing why it is true. For example, we know that telephone and electric bells ring, that water freezes, that wood burns; but we do not know why these things happen. Similarly the ancients knew that the moon has phases, that both sun and moon undergo eclipse, that the planets have a different path through the heavens from that of the other stars, that the altitude of the sun in winter is less than it is in summer; but they did not know why these things are so.

As science progressed it was discovered why these propositions known to the ancients are true. In the days of Galileo Europe learned that the sun, not the earth, is at the centre of the solar system, that the earth revolves on its axis and that it and the other planets revolve about the sun. This theory accounted for the facts then known and other facts soon discovered, such as, that the planets go through phases as does the moon. Thus many facts became logically

connected which before seemed quite isolated. But other facts remained still unexplained and logically unconnected. Why the ocean tides? Why the velocity, the path about the sun and the distance from the sun, of each planet? Why the various perturbations in these planetary orbits? One proposition discovered by Sir Isaac Newton explains in part all these truths, and connects logically such seemingly isolated truths as the falling of an apple, the ebb and flow of the tide, the length of the year, the shape of the earth's orbit, and the origin, the age, and the destiny of the solar system itself. And the end is not yet; for if the day ever comes when the physicist can explain gravitation, we shall probably be able not only to account for many things we now know to be true but also to connect logically truths which now seem completely isolated. Thus as science progresses propositions are discovered each of which in part explains a large number of other propositions and thereby connects these many truths logically. Such propositions are spoken of usually as generalizations. In short, as knowledge grows it becomes unified, it becomes general knowledge. Thus far we have seen two respects in which science progresses, first our information increases in extent, and second in logical connection, or generality.

In the third and last place, science progresses by gaining in logical rigor. This means two things: first, the discovery of the ultimate or more nearly ultimate terms and relations of our sciences and through them the precise definition of the other terms and relations; secondly, the discovery of the ultimate or more nearly ultimate

premises presupposed in our sciences and thereby the reformulation of these sciences to a greater and greater extent as thoroughly deductive systems. In short, science becomes logically more explicit. As a man becomes wiser and more thoughtful, he tries to use his words with greater precision. He does not say linen when he should say cotton, brass when he should say bronze, dirt when he should say clay, curve when he should say parabola. Again, he becomes more widely acquainted with the principles which guide him in his decisions and the premises which are presupposed in his opinions. If he holds to a certain political policy, he knows whether or not it is a mere dogma or a well-founded conviction. If he has certain strong artistic likes and dislikes, he may see and acknowledge that they are idiosyncrasies and are blind. Finally, if some of his opinions clash or are quite inconsistent he may notice this and give up one or the other. In short, he has become more self-critical, more consistent, more profound in his thoughts and more open minded. Evidently every normal adult in a civilized land has made some progress in these respects since the days of his childhood.

The same truth holds of the progress of science through the centuries. In the various sciences greater logical rigor is evident everywhere, except where it has been delayed by the rapid accumulation of new information; and in the exact sciences especially terms and relations are defined with greater care and often with remarkable accuracy. Nowhere is this so wonderfully the case as in mathematics.

In the other respects also the sciences progress notice-

ably. As long ago as Euclid the geometrician endeavored to teach his propositions as explicit deductions from precisely formulated premises. In our own age, however, the mathematician has far outstripped his predecessors in the rigor of his deductions, in the reduction of the number of premises required and in their explicit formulation; until to-day mathematics is the intellectual wonder of the world, the most perfect of the sciences, the body of knowledge which most nearly fulfils the conditions of the ideal science. Moreover, what has been possible in mathematics does not appear impossible for the other sciences. True its realization seems indefinitely far in the future, but we are fully aware that physics and chemistry and biology are nearer this ideal of logical rigor than they were. Much of physics can be put in a thoroughly deductive form as can also parts of chemistry; and perhaps we are to-day on the verge of discovering premises from which the periodic law and many of the phenomena of chemical affinity may be rigorously deduced. Now all such progress brings with it not only a more nearly deductive formulation of our knowledge but what is especially pertinent, a knowledge of the gaps in the argument, a greater awareness of what are mere working hypotheses or postulates, an insight into the inconsistencies of our theories and the merits of rival hypotheses. Our science to-day is less dogmatic, more cautious, more open minded, and more critical.

Thus we get a third respect, which with the two preceding gives us the following three elements that constitute the progress of science. First, there is the increase in knowledge and the mere multiplication of facts and of

other truths requiring to be explained. Second, there is the increase in generalization, in the number of truths which are explained and thereby logically connected, in the unification of knowledge. Third, there is the increase in logical rigor. The terms and relations are defined with greater precision and with the employment of fewer ultimate notions. The logical gaps are more apparent. The premises are explicitly assumed and reduced to a minimum and the formulation of the science approaches nearer the ideal of the explicit and rigorous deductive argument.

2. *The place of metaphysics in science.*—If now we recall what was said in the second chapter, we shall see that the second and third respects in which the scientist endeavors to advance knowledge is precisely what we mean by philosophy. Indeed we could here substitute for the expression "Science progresses," the sentence, "Science becomes more philosophical;" for philosophy is not so much a name of a certain body of information as an aspect of our knowledge in general as it progresses from a more primitive to a maturer stage. In other words, one science is more philosophical than another, not because it studies numbers, or matter, or protoplasm and the other does not, but because it has reached a higher stage of development than has the other. The philosopher has no extra source of information or outside field for research beyond that in the possession of the mathematician, the biologist, the social scientist, the artist, the teacher of religion. Rather he has precisely what they have, but his special interests are confined to two aspects of their information; first, the generaliza-

tions to which it leads, its unification, and secondly, its logical rigor and cogency.

The second chapter told us also that metaphysics as a branch or discipline of philosophy is a study whose field is confined to that of science in the narrow sense, in other words, to the problems of reality. As such it is therefore that aspect of scientific growth which consists, first, in formulating the highest generalizations warranted by man's existential knowledge, and, secondly, in organizing this knowledge into a logically rigorous and explicit system of information. In other words, every scientist who is endeavoring to reach higher generalizations regarding the existent world, be he astronomer, physicist, biologist, psychologist, or any other student of the real, is *ipso facto* a metaphysician. So too is every student who seeks to discover and to define the fundamental terms and relations of his science and to make explicit the ultimate premises upon which his science logically rests: in short, every student who is seeking the logical foundations of the sciences.

Here it is highly to be desired that we should notice that philosophy and metaphysics are not matters of merely academic pursuit and interest. They constitute an aspect of man's intellectual history the world over. Indeed, they form a chapter in the history of civilization itself. As man has progressed he has sought to unify, to generalize, what he knows or believes; he has striven to see more clearly what logically underlies his opinions and convictions. As he has done so, he has made not only great discoveries, discoveries that completely revolutionize his picture of the world about him and

within him, but also great changes in his manner of reacting to that world. Thus the whole intellectual history of man from savagedom to modern Europe is not merely an accumulation of bits of information and correction of individual errors, but also a gradual transformation of the whole outlook upon reality from a narrow and superficial to a broader and profounder vision. It has been not only an increase in knowledge but a philosophical growth within knowledge. Thus in studying philosophy we are gaining an insight into human history, human nature and human life as truly as we are when we study man's political, social, and economic customs and institutions; for the philosophical convictions of men to-day, from those of the ablest scientist to those of the humblest peasant, are one and all the gradual outcome of centuries upon centuries of human experience and thought. Therefore to think of philosophy as something solely in books, or in the minds of a few bookworms or dreamers would be to make as great an error as to think in the same way of economic, social and political policies and customs.

Again, it is important that we should notice that our philosophical knowledge not only has evolved but shows all the usual marks of evolution. That is, precisely as different peoples and different geographical sections, and different strata of any nation's population reveal different stages of economic and social development and precisely as you will see in them side by side with the new vestiges of the old and even of the very ancient; so also will you find a similar state of affairs in philosophy. The primitive and barbaric can be found side by side with the

most enlightened. As you can find to-day in the slums of New York medical practices of centuries ago, that you thought long obsolete in civilized communities; so too can you find even in the learned, philosophical opinions that were held and refuted ages ago. Again, as the expression of to-day, "The sun rises or the sun sets," points back to a time when the earth was literally believed to be stationary and to be the centre of the universe, so too do our ordinary notions, for example, of force, of causation and causal law, point back to the primitive days when men believed most objects and events in nature the abode of spirits and demi-gods.

Finally, it should be noticed that as science evolves so also must its philosophy. As the special theories of science often prove false to fact, inadequate, or too simple for the complexity of fact; so also do its fundamental notions and assumptions and its higher generalizations. Science outgrows its philosophy, and a new philosophy has to be gradually formulated to take its place. This process of changing from the old to the new is usually, however, a slow one; for men are more conservative in their philosophical convictions than they are in their belief in this or that particular fact; and often they accept facts which explicitly contradict philosophical opinions still held tenaciously. Hence we should learn at the beginning of philosophical study that the epochs of science mean also epochs in metaphysics, that the great discoveries in science in the past have brought with them radical changes in metaphysics and that the same fate is no doubt in store also for the metaphysical theories of our own day. In its way then the attempt

to formulate a metaphysics for all time is as absurd and disastrous as would be the attempt to force upon a nation a constitution and a code of laws which could never be amended or revised.

FOR FURTHER STUDY READ BOOKS ON THE HISTORY OF PHILOSOPHY AND OF SCIENCE, ESPECIALLY:

Windelband, History of Philosophy;
Höffding, History of Modern Philosophy;
Merz, A History of European Thought in the Nineteenth Century.

ON THE HISTORY OF SCIENCE READ ESPECIALLY BOOKS ON THE HISTORY OF ASTRONOMY, MATHEMATICS AND PHYSICS:

Ball, History of Mathematics;
Cajori, A History of Elementary Mathematics:
Mach, Science of Mechanics;
Cf. also references at the ends of Chapters XIX–XXII.

PART III

PROBLEMS OF GENERAL METAPHYSICS

In the foregoing part we have pointed out certain fundamental aspects of that which we know, we have defined certain fundamental terms, and we have studied the nature of common sense and of science. In so doing we have taken for granted a number of propositions whose truth is seriously disputed. These propositions we must now examine, for upon their truth or falsity depends our entire conception of the world. Perhaps the most convenient method by which to keep our new problems in mind is to think of them centering about our conclusion, "the world is the true and complete explanation of what we perceive." Philosophers differ as to what we perceive, as to how far it can be explained, and as to the fundamental notions and postulates, in other words, as to the nature of explanation itself. We shall study the resulting issues in what seems to me their most appropriate order, and each will be defined as we come to it; but, note well, the one problem which remains the central thought throughout is the validity of the results already reached.

CHAPTER VII

ROMANTICISM AND LOGIC

1. *The problem.*—The preceding chapters have set forth the hypothesis that the world is the complete explanation of what we perceive and is a system of terms in relation. Against this hypothesis the following objections have been raised by one philosopher or another: (a) What we perceive cannot itself be analyzed into terms and relations. (b) The perceived can be only perceived, it can in no way be explained. (c) Or, if the perceived can be explained in some of its aspects, it cannot be explained completely. These doctrines may be called *romanticism* and the opposed doctrines such as those of the preceding chapters may be named in contrast *intellectualism.*

2. *Can what we perceive be analyzed into terms and relations?* (*a*) *The negative answer.*—The basis of both the extreme and the moderate romanticism is the proposition, *the perceptual is unanalyzable and is not composed of terms and relations.* As you look at a basin of water what you see is not a thousand drops of water but one unbroken total, or unity, the water. A river is one flowing stream, not millions of buckets of water packed together like sardines in a box. As you listen to a melody what you hear is not a series of tones but a flowing unity of sound, complex to be sure but none the less undivided. If you are angry what you feel is not a compound, a sum made

up of feelings of clenched fist, scowling forehead, flushed face, and so on. Anger is just anger, and though complex, it is one unanalyzable feeling. A landscape too, as seen by us, is of course quite complex, but there is a unity to it which would be quite lost did we analyze it into so many mountain tops, so many trees, so many rocks, so much green grass, so many head of cattle. It is not these patched together, it is a total whose unity is more than the sum of the so-called parts. Again the feeling of a succession of events, a train dashing by, a horse running, a waterfall, the wind, the throb of a toothache, the flow of our life from moment to moment, or any other case of change and of duration is not made up of bits or stages, each a stationary changeless state. Time is not now, now, now, now, or the successive ticks of the clock, but is an unbroken unanalyzable flow. Motion too is not here, then here, then here, then here; rather it has no stages. It is not made up of rests, one in each point of the line of travel. Not only does it flow on, but it flows evenly and without break. Therefore to analyze it and to regard it as the sum of positions in different moments is to ignore or to destroy its most prominent characteristic. A broken egg or a broken vase, no matter how expert the man who mends it, is never again the original unbroken object. The totality forms a unity, precisely as a human body full of life, energy, action, is not a mere aggregate of bones, muscles, blood and other parts.

(*b*) *The affirmative answer.*—The doctrine thus outlined is guilty of one or more of the following implied errors: (1) To analyze what we perceive does not mean

to take what we perceive to pieces. When I analyze the motion of a ball tossed in the air, or of a running horse, I do not stop the ball or the horse each instant to get a series of photographs as it were. When I analyze the American flag into white stars in a blue field at one corner surrounded on two sides by thirteen red and white stripes in succession, I do not tear the flag to pieces. When I analyze an animal's body into its constituents, head, trunk, legs, tail, I do not butcher the animal. I simply *find* in the total complex, the unity, such and such constituents, thus and thus related. A flying projectile does go *through a path*, the *shape* of that path is a *parabola*, the projectile is in *different places* at *different times*, it is *there before* it is *here*. This I *see* or *find* without touching the ball, stopping the ball, or doing anything but looking sharply.

(2) That a thing, an event, or in general, any complexity, has not yet been analyzed, in no way proves that it is unanalyzable. *Unanalyzed is not the equivalent of unanalyzable.* It is evident that some things are more easily analyzed than others, that some things have been analyzed even by children and others have not been even by the most skillful laboratory methods. On the one hand, a child can see in the American flag its geometrical form and structure and the arrangement of the colors. On the other hand introspective psychologists may be far from agreement as to the makeup of our thoughts, and sensory experiences. However, the important point is that many things which in days gone by have completely baffled analysis have in later days been analyzed. Analysis requires education. Moreover, analysis is al-

ways a genuine discovery, and, as any other form of discovery, has to wait for the discoverer. It has to wait as truly as America had to wait for Columbus. The child has to learn to see the parts of a bird, or the geometrical relations between the parts of an ellipse. Mankind had to wait for a Helmholtz to point out the constituents of a given note of a violin, piano, horn, or of the human voice, and to show what these notes have in common, and wherein they differ. Now that we have been taught, the discriminating ear can easily apprehend what no man one hundred years ago noticed, the constitution of sounds. Thus the absence of analysis is never a proof that the unanalyzed is unanalyzable. Neither is it, of course, proof of the opposite. But inasmuch as one thing after another has revealed its constitution (as perceived) to the sharper insight of the discoverer and the trained observer; it is certainly better to entertain the working hypothesis that all complex objects of perception, which as yet remain unanalyzed, can be analyzed. There is from the nature of the case no positive evidence against analysis. In other words, when anyone maintains that some perceived object is a complex unanalyzable unity the utmost that he is justified in maintaining is that it is a complex *unanalyzed* unity.

In short, the intellectualist teaches in opposition to romanticism: (a) that to analyze what we perceive is not to destroy it, or to alter it, but is to find and to discover in the genuine and literal senses of those words; (b) that though analysis is a slow process of discovery requiring true genius, yet an immense amount of successful analysis is already to man's credit; (c) that the fact,

that any perceived object or event has not yet been analyzed, is no proof that it will not be or cannot be; (d) that analysis must proceed until the genuinely simple (or non-complex) is discovered; (e) finally that we can never be sure of having reached the truly simple even where the object perceived seems simple and we can be confident of not having reached the truly simple as long as the object remains complex. The safer working hypothesis is, *there are no complex unities.*

3. *Can what we perceive be explained?* (*a*) *The negative answer.*—The romanticist believes that the methods by which the scientist explains, fail in a second respect. Explanation singles out certain aspects of the perceived world and endeavors to interpret, or describe the other aspects by means of these, or it even attempts to reduce these other aspects to the ones singled out. As a result, explanation reduces the world to one of its countless aspects, not because this aspect is in itself important but because it is convenient, though all these various aspects are not only totally different but are ultimate and irreducible. The two most prominent aspects of things which are used as a basis of explanation, the romanticist claims, are the *spatial* and the *static.* That is, in explaining we spatialize things or aspects of things which in no way are spatial, we treat as static, changeless or permanent what is really dynamic, changing and developing. To make this clear we must study instances. If we wish to measure the rising temperature of a room we do so by measuring the length of a column of mercury (the thermometer), let us say, every thirty seconds. But the real heat of the room is not the length of this

column; therefore we have substituted for this real heat a very different object, a scale on a thermometer, a geometrical entity and one easily measured. The real heat, the heat that we directly perceive, does not increase in the sense of becoming longer or shorter. Thus it has been ignored and its place in our thought has been given to another, the thermometer. Now the romanticist admits that what we have done is far more convenient and useful. He says, for practical purposes judge of the heat of a room by the thermometer rather than by direct perception; but he protests, when we go beyond the practical and assert that our method actually measures the heat. Again, consider the way in which we spatialize sound. We call one note higher or lower than another, but this is only a figure of speech, for notes are not literally higher or lower in the sense that the steeple is higher than the church or the valley is lower than the mountain. Further when we explain sound we do so by the theory of air waves. To each note we assign waves of a certain configuration and length. But sound as actually perceived has none of these spatial characteristics. In terms of vibrations one note may be 256 and another 512 waves per second, but as heard one note is not twice the other in any literal or numerical sense. Finally, take the case of time: we measure it usually by the *distance* traveled by the sun or the hands of a clock. But *time* is *not distance.* We can feel or perceive time and as felt it is not the change of spatial position of any thing. It is just time. Yet when the scientist thinks of it he usually thinks of it in terms of space and he usually draws a *line* to represent it.

Notice too that when we spatialize we really make things static, for space itself is changeless, and also the occupation of space (no matter for how short a time) is changeless. Hence changes of any sort, such as motion, growth, expansion, increase, flow, the passage of time, when represented or symbolized in terms of space, are described in terms of the changeless, the static, the permanent, in short, in terms that belie them. If you represent time as a line you ignore its very nature, for a line is "all there at once," is "changeless;" whereas time is an "on flowing," "a passing," is much like the crest of an onrushing wave. In short, wherever in science the romanticist directs his attention, he finds over and over again this same or similar falsifying of the perceived by measuring it or by reducing it to terms that are spatial and static.

Thus he draws the conclusion: However valuable science may be as an instrument to guide our conduct, it does not reveal the true nature of the real. Moreover, this fault of science is irremediable, for to explain is of necessity to spatialize and make static. Hence the real cannot be explained; it can only be perceived, felt, or lived. In other words, the poet is far nearer revealing to us the genuinely real, for he feels it and does not try to explain it. His insight is not an explanation which distorts and falsifies but an intuition which appreciates and enjoys.

(*b*) *The affirmative answer.*—This doctrine of the romanticist the intellectualist finds both false and absurd. It is absurd, because it leads to extreme obscurantism by rejecting science as untrue and to utter license

by removing all workable tests of truth and falsity. It is false, because the romanticist misstates the true nature of explanation. True explanation never identifies the spatial with the non-spatial, or the dynamic with the static. Moreover, a large number of terms in science which if pictured would no doubt be pictured as spatial, are themselves entirely non-spatial. Finally and chiefly, the romanticist forgets that explanation includes not only terms but also *relations*. Let us illustrate these three points. The scale of a thermometer is of course not itself heat and no scientist, who is rigorous in his thinking, would identify the two or identify time and a line, or anything else with the spatial unless actual analysis reveals that it is spatial. Secondly, because the spatial aspects of things are more easily perceived and because spatial words or symbols are often the most convenient, this in no way shows that what the scientist means by his words and thoughts is spatial. If he represents time by a line, he does not mean that time is a line; or if he represents velocity and acceleration by lines he does not assert that either is a line. If his terms are fixed by definition and so *logically static*, this does not prevent them from being entities which are dynamic, changing, or anything else. In any case, let us not confuse this logical fixedness of terms, which alone makes them definable, with the static of physics. Thirdly, when the scientist analyzes change, time, motion, acceleration and other such terms he may actually find in them certain static features, or he may actually find that they are certain static terms *related* to one another in certain ways. In the latter case especially it would be falsifying the

real, did we notice only these static terms and forget to mention the *relations between them* which are as truly parts of the entity analyzed as are the elementary terms. For example, if we analyze time into terms (called "instants") related to one another in certain ways (called, let us say, "before" and "after"), this means, we actually find this to be the constitution of time and we find these relations there as truly as we do the instants. Did we leave these relations out, of course, the analysis would falsify by ignoring an essential aspect of real time. So too if we analyze motion into a relation between points of space and instants of time, the result is of course logically static; but the entity analyzed is not physically static, for it is motion itself. If we ignore *this relation* between the points of space and the instants of time, then indeed we have on our hands nothing but static and changeless entities, the points of space and the instants of time. For example, a point defined in geometry is an absolute static; three o'clock at such and such a place on the afternoon of such and such a day is for all ages a fixed instant of time.

But the intellectualist can bring the argument even closer home. If explanation really falsified, how could it be even of practical value? How can the astronomer predict to a moment the time of an eclipse, how can the physicist give us the electric motor and the wireless telegraph, or how can any other scientist give us the marvelous inventions of modern days, unless he has a true knowledge of the real? The romantic hypothesis makes his deed utterly miraculous. In general, as we have seen in an earlier chapter, the very test of explana-

tion is perception. Then how can it be that scientific explanation, which stands this test, is a mere practical device, belying perception? The only explanation of the romanticist's belief seems to be that he looks upon explanation itself as a literal description of what we perceive; whereas to explain, we learned in an earlier chapter, is to deduce from premises, and there is no question but that the scientist deduces from his theories what we perceive. In short, the romanticist seems to misunderstand both analysis and explanation.

4. Can what we perceive be fully explained?—Some romanticists might admit all that has been thus far urged in defense of science, but maintain that though we can explain *in part* what we perceive, we cannot do so *fully*. This objection may mean several things. (a) It may mean that the world is infinitely complex and that the work of explaining it fully is like counting from one, two, three, four, up to infinity, which counting, of course, can never be completed. The world may be infinitely complex; but, if so, this does not tell against explanation as such. Explanation as far as it goes is a valid knowledge of reality; as far as it goes, it fully explains: and the only cure for our ignorance is more explanation. In short, the trouble is not with explanation as such, but with the ignorance of which the finite mind must always be guilty. (b) The objection may mean that each *part or element* of the world is infinitely complex and therefore can never be fully explained. As a consequence nothing which exists is fully known, or fully analyzed and never can be. If this be true, the same reply is again pertinent. It may be that every grain of sand is itself a little world,

precisely as complex as the universe of which it seems to be so insignificant a part. Then indeed man will never know any object fully; yet here too the cure of ignorance is not poetry or feeling but more explanation. If we cannot know fully the grain of sand we can know many of its aspects, its terms and its relations. (c) Finally, the objection may mean that though some things can be analyzed and explained, others cannot; or again, that though some aspects of things can be analyzed and explained, other aspects are inexplicable. Against this objection the original reply is valid. All such cases of "complex unities" prove merely that as yet we have not been able to analyze. They do not prove the impossibility of analysis. Thus examined in all its forms, however valuable romanticism may be in pointing out the richness, variety and complexity of the world, romanticism is in error in undervaluing explanation and substituting feeling for knowledge.

FOR FURTHER STUDY READ:

James, Pluralistic Universe, Lect. V, VI and VII;
James, Some Problems of Philosophy, Chap. V;
The New Realism, Spaulding, A Defense of Analysis, and Holt, The Place of Illusory Experience in a Realistic World, 308–355.

FOR MORE EXTENSIVE STUDY:

Bergson, Time and Free Will;
James, Some Problems of Philosophy;
Perry, Present Philosophical Tendencies.

CHAPTER VIII

LOGICAL MONISM AND LOGICAL PLURALISM

1. *The problem.*—There is a third position, a position between romanticism with its doctrine that the real is a flowing complex unity, unanalyzable and inexplicable, and the intellectualism of the preceding chapters. This position is said to be intellectualistic but often it more resembles romanticism. It is called *logical monism* and the opposed intellectualism is named *logical pluralism.*

The issue between them is whether or not the following postulate of formal logic is true of reality: terms in relation are not constituted by their relation; but each term is what it is independently both of its relations and of the terms to which it is related. This postulate may be more precisely "expressed" by saying that (a) relatedness does not imply any corresponding complexity in the *relata* (things related); (b) any given entity is a constituent of many different complexes. To illustrate:

(a) If v is related by R^1 to x, by R^2 to y, by R^3 to z (vR^1x, vR^2y, vR^3z), this does not imply that v is complex, for v may be quite simple. The apex of a given triangle may be also the apex of an infinite number of other triangles, and the centre of a like number of circles, without being in any way complex, for it remains the simple entity called a point. In those cases where v is complex, the relations in which it stands do not imply

any corresponding complexity. Take a straight line, which of course is complex. As the radius of a circle, the side of a square, the altitude of a triangle, it is the identical line in the three relations. No inspection of its properties would force us in any way to alter its definition as we pass in thought from the one relationship to the other. Consider another case. A man is a father, an uncle, a brother, a cousin, a son, a grandson, as he stands in different relations to different people. These relations do not imply a corresponding complexity in the man himself. Moreover, a new relationship might be formed by the birth of a son to his cousin without altering the man.

(b) Again, in all these cases the same term is not only identical in its different relations, but it may be a constituent of many different complexes. The one and the same point may be a point on many lines. The one and the same man may be a member of half a dozen clubs. The very same vowel may be a part of a thousand different words. The very same proposition may be asserted in a hundred different books.

2. *The significance of the problem.*—This postulate, asserted by pluralism and denied by monism, is frequently called "the external theory of relations." It is of great importance, for as it is asserted or denied there follows a radically different conception of the world. If the postulate is true, the world is the totality, sum, or aggregate of its members, and the extent to which each of these members is logically independent of the others can be ascertained only by empirical research. If the postulate is false, the world is a complex unity. Noth-

ing is logically independent of any thing else. Each constituent of the world is what it is because of all the other members. If the postulate is true, there are ultimately simple entities and therefore changeless entities. If the postulate is false, "simple terms could have no relations, and therefore could not enter into complexes; hence every term would have to be strictly infinitely complex." That is, as relatedness would then imply complexity, the fact that a point is the apex of an infinitude of triangles would imply that the point is itself infinitely complex, and as everything stands in some sort of relation to all other things, everything must be infinitely complex. Indeed there would be no simple terms.

If pluralism is true, the world is made up of many things which are distinct and logically independent; perhaps of infinitely many. We do not know that it might not have been quite different in many of its relations and terms from what it is and yet have been quite the same as regards its other terms and their relations. For example, there may be parts or elements of the world which would in no way be different if Cæsar had not crossed the Rubicon, or indeed even if there were no such relation between the particles of matter as that expressed in the law of gravitation. Even if the sun did not attract the earth, the physical world might still remain a world in which the Euclidean geometry is true. Even if water could not become hard and stone like, the laws of mechanics might still be true. Of course no one will deny that in other respects the changes in the physical world would have had to be enormous.

If monism is true, the world is an organic unity. An object is said to be an organic unity when each part is what it is because of the other parts, when the whole is what it is because of the parts and the parts what they are because of the whole. The living organisms suggest such unities. Biology regards such a creature as a mermaid as impossible. Man's body could not have a fish's tail. The one part of the body indicates what the other parts must be. The hand, the foot, the heart, the lungs, the brain, belong together and had the form of one of them been markedly different, it seems highly probable that the form of the others would also have been quite other than they are. A favorite example is that a paleontologist discovering one tooth or bone of an unknown animal might be able to reconstruct in drawings its outward form and internal organs.

Finally there remain two further and very important differences between pluralism and monism. First, if pluralism is true, logical analysis is possible, whereas it is not possible if monism is true. Not only would analysis never arrive at a genuinely simple term, but it could never even mention the real constituents of any complex, for each of these constituents would be itself constituted by the complex. If the complex is *abcd*, we might not call *a* a constituent, for *a* apart from or out of relation with the *bcd* would not be the *a* of the complex. If the complex were a triangle we could not truly analyze it into the constituent sides, angles, and their relations. If the complex were a musical melody we could not truly define the notes and their relations of which it is constituted. In common then with the ro-

manticist the monist regards all rigorous analysis as a falsification.

Secondly, if pluralism is true it is possible to study and to understand one part or aspect of the world and reach correct conclusions though we be quite ignorant of most other parts or aspects. We can isolate our problems and solve them one at a time. We can learn one truth and later learn a second truth without revising the earlier information. Thus mathematics does not have to wait until physiology or meteorology become almost perfect sciences. Thus in general one science can, without serious fear of error, be far in advance of this or that other science; and some problems can get their true and final solution regardless of whether or not many others ever get solved.

But if the monist is in the right, none of this is true. We can never know the truth about anything until we know the truth about everything. We cannot isolate problems and solve them, for their true solution must take into account the entire universe. Hence the sciences that appear to be independent one of another really are not. Strictly speaking, we cannot add to our knowledge anywhere, for to do so means to alter it everywhere, in other words, to transform it. For example the monist might say: see how completely the discovery of the shape of the earth and of its position and motion in the solar system revolutionized Europe's whole world hypothesis a few centuries ago. Behold how great a change in our beliefs has been wrought by Darwinism. In short, history shows everywhere how wide-reaching in its effects is the change of some crucial belief; and if this

wide-reaching effect does not take place when other beliefs change, this is simply due to the inertia of human thought and insight. To conclude, the contrast between the two positions is clear: the pluralist teaches that our information grows by *addition*, new information can be added to old information; the monist on the other hand asserts that our information grows *organically*, new information transforms all our old information.

3. *Arguments for monism.*—(a) The monist claims that the postulate presupposed in all science is, "*the world is a unity.*" Unless the world is a unity, it is simply an aggregate of more or less disconnected worlds and some of them may be absolutely unknowable even to a perfect intellect inhabiting other systems. Unless the world is a unity, the sciences must remain more or less disconnected and it can never be understood why they are true as a group. Ultimately we shall have to be content to know this is true and that is true but never why both this and that are true together. Only then in case all truths are parts of one truth and can be understood as such will the world total be intelligible. Now whatever postulate makes the world either unknowable or unintelligible cannot be consistently entertained by science. The pluralistic hypothesis does so, therefore it must be rejected.

(b) *As our knowledge grows things have been found to be more and more interconnected.*—The civilized man feels that the world of the savage is chaotic because his own world in contrast seems interconnected and unified. For example, the law of gravitation connects an untold number of events that to the uneducated seem

far apart and quite independent. To-day light, heat, electricity and magnetism seem closely related energies. The doctrine of evolution has made the forms of animal and plant life, the institutions, customs, languages and arts of different peoples all seem but different chapters in one connected story of earthly life. In short, increased knowledge reveals increased interconnection and complete knowledge would reveal complete interconnection.

(c) *A study of the growth of knowledge in the individual and in the race shows that knowledge grows not by addition alone but by transformation or evolution.*—The child may use the same words as the man, but he does not mean by them the same things as the man. This is true even of the simplest statements, "That is a cow;" "Two and two are four." Our whole method of apperceiving changes, and therefore it is impossible to retain any of our childhood's views, attitudes or judgments, or even what childhood seems already to know well. The same difference is apparent when we contrast the world of the modern western European with that of the medieval European, or of the Oriental, or of the savage. Even the most trivial matters of daily life which every one seems to know well, are differently conceived and understood by different peoples. Thus if growth in knowledge alters our whole way of apperceiving, a higher knowledge than ours would find all that we believe never quite true but only relatively true, only on the way toward truth; and finally a highest or perfect knowledge alone would know any thing as it truly is. Now all this indicates that the object of knowledge as well as knowing is an organic

unity. If it were an aggregate of independent objects we could know it part by part, and as we added to our knowledge we should not have to revise all our earlier information. But we cannot know it part by part; therefore the world which forms the object of knowledge cannot be an aggregate.

4. Arguments for pluralism. (a) *Monism reduces to skepticism and even to absurdity.*—It teaches that we cannot truly know any thing until we know everything. For example, we cannot truly know that two plus two equals four until we learn the name of the prisoner who wore the iron mask. Even monism itself cannot be known by the monist to be true; rather it cannot be quite true for did the monist know more, he would, here as elsewhere, alter his doctrine. In short, nothing that we believe is quite true.

(b) *The most important method of scientific research is to isolate problems.*—Monism denies that this can be done. But as a matter of fact science does isolate problems and has been most successful in ascertaining thereby truths which the monist accepts as readily as any man.

(c) *As a matter of fact the sciences do progress at different rates.*—Certainly mathematics is far in advance of meteorology. This fact cannot be explained unless the truths of mathematics are logically independent of the generalizations of meteorology. Of course discovery in one field does often lead to discovery in another field. But the fact that one discovery is connected with another discovery, does not prove that the things discovered are logically connected. The sum of the angles of a plane triangle do not equal two right angles

because Cæsar crossed the Rubicon; yet it might happen in some child's life that the learning of one truth was connected with the learning of the other.

(d) *The extent to which and the respects in which the world is a unity cannot be assumed at the outset of scientific research.*—Only by a study of facts can we get this information. It is true that events and things in remote parts of the known world have turned out to be interrelated in ways undreamed of by the wise men of five hundred years ago. But this interconnection is not of the sort monism teaches. It is logical or causal, not organic.

(e) *It is true that pluralism implies that we cannot unify knowledge if to do so means to make all truths one truth; but this is not what science means by unification.*—To unify means to find more and more general truths, means to find interrelations, means to make science more and more deductive. Now all of this contradicts neither the externality of relations nor our formal logic which presupposes this externality.

(f) *The extent to which the growth of human knowledge in the individual and in the race is organic, is indeed an important problem for psychology to solve; but the matter is not relevant to the present issue.*—The question is, not how does man's knowledge grow, but how are things in nature and everywhere else logically interrelated? The way in which our knowledge has grown has nothing to do with the logical relation of mathematics and chemistry.

In general, formal logic and science postulate and presuppose the external theory of relations. Of course, as is true of any other postulate, this too is subject to correc-

tion by fact; but where as yet are the conflicting facts, or where as yet are the errors to which this postulate has led? Moreover, those who believe the organic theory to be true, do not, and as far as we know cannot, adopt it in science. The whole enterprise of science and of logic depends upon the contradictory of the organic theory, and the very monists who defend this theory use logic in their reasoning. There may be some escape from the absurdity of this position but no monist seems as yet to have made it apparent.

FOR FURTHER STUDY READ:

Russell, The Basis of Realism, *J. of Philos., Psychol., etc.*, 1911, *8;*
Russell, Philosophical Essays, 150–169;
James, Pluralistic Universe, Lects. II and III;
James, Some Problems of Philosophy, Chaps. VII and VIII;
Bradley, several articles in recent volumes of *Mind;*
Stout, Alleged Self-Contradictions in the Concept of Relation, *Proc. Aristotel. Soc.*, 1901–2, *2.*

FOR MORE EXTENSIVE STUDY READ:

Joachim, The Nature of Truth.

CHAPTER IX

THE CRITERION OF TRUTH

1. *The problem.*—Closely connected with the issue between logical monism and pluralism is the question whether or not logical consistency is the sole ultimate test of truth. Indeed all monists do and must hold to the view that consistency or coherence is such a test; whereas the pluralists are divided on this question.

Formal logic teaches that of two contradictory propositions one must be true and the other false. "A is B," and, "A is not B," cannot both be true. Hence whenever contradiction is found in our information we know at once there must be error somewhere. From this principle is inferred not only that truth is free from contradiction but that any body of knowledge which is free from contradiction is so far true. In short, truth can be defined, for truth is logical coherence. Moreover, logical coherence is the sole test of truth.

Opponents of this theory admit that logical consistency is indeed a very important test of truth but deny that it is either the sole test of truth or an ultimate test. They maintain that the sole ultimate test of truth is perception. A perceived truth is self-warranted and needs no further support. Through perception we may ascertain other important tests of truth such as the principles of logic and even some of the postulates and deductions

of science. For example, not only is logical consistency an excellent test of truth, but so too is arithmetic when used to refute a man's bad reasoning. Indeed any perceived truth may be a test of another proposition whose truth is not perceived but inferred.

2. *Consequences of the two theories regarding the ultimate test of truth.*—If the coherence theory be correct, there are no self-evident truths except the principle of contradiction itself, which, inconsistently, has to be admitted to be self-evident. The only method by means of which we can learn of the greater truthfulness of the adult's knowledge as compared with that of childhood or of modern science as compared with that of medieval Europe is internal coherence. The knowledge of the adult excels that of childhood and the information of modern science excels that of medieval science in two respects. Such knowledge is less fragmentary and more extensive, and freer from contradiction or inconsistency. As we grow in knowledge, we know more, there are fewer gaps between different parts of our knowledge, and the whole logically hangs together to a greater degree. Moreover, any part or field of knowledge may be superior in coherence to other parts, and this explains why we regard such a field as nearly or even as quite certain. But besides these reasons there is none for regarding one proposition or portion of knowledge as better founded than others. Indeed we cannot be sure that any proposition is true; because it is not enough that it should be consistent with what we already know, but it must be consistent with all truth; and of course we lack complete knowledge. In short, no one except the possessor

of all truth can know whether or not any given proposition fits in harmoniously with all the rest and is therefore true.[1]

If the perception theory is held, it is not in any way denied that logical coherence is a most important, sometimes the most important, test of truth, but it is affirmed that our knowledge of many propositions and subjects has a degree of certainty out of all proportion to what this knowledge would have were coherence the sole criterion, and it is even affirmed that some parts of our knowledge are certainties or virtual certainties. Perception tells us many things directly. We actually learn *truths* by looking, observing, examining and thinking, quite apart from any question of logical relations to other truths. I can *see* that no lamp is standing on my table. I can see that one man is taller than another. I can perceive that the American flag is made up of thirteen red and white stripes with a field of blue in one corner in which are many white stars.

How far we can perceive is indeed a difficult question to answer because there is no clear cut boundary line between what is almost perceivable and what is just perceivable. Moreover, we differ man from man in our various abilities to perceive. One man has great mathematical insight, another artistic, another musical, and

[1] Notice how admirably this supports logical monism; for, strictly, there are no truths, there is but the one all inclusive and coherent truth. What man possesses is only *relatively* true, it is true as far as it is consistent and complete. Never can we say of the result of any science, such as mathematics, that it is *absolutely* true.

another mechanical. Then again, as the opponents of the perception theory rightly point out, no actual perception is unaccompanied by inferences and it is very difficult to decide precisely where perception leaves off and inference begins. For example, when I perceive that A is taller than B, am I not guilty of some inference? Am I not assuming that they are both equally distant, and that I am not deceived in many possible ways? Any one who has watched professional sleight of hand performances knows only too well how fallible we can be in believing we do see or in ignoring what we should see.

Finally there is the important question, can we perceive universals and truths regarding universals? Do we perceive that two plus two equals four, that things equal to the same thing are equal to each other, that if class *a* is included in class *b* and class *b* is included in class *c* then class *a* is included in class *c*? Some maintain that though such truths are very close to the perceivable and have a large measure of perceptual warrant, they are more general than truths we can perceive. Others who hold the perception theory think that these and many other axiomatic truths which form the foundations of logic and mathematics are fully perceived and therefore infallible intuitions. In any case, those who accept perception as an ultimate test of knowledge point out that such truths have a more nearly complete warrant than if coherence were their sole test; and that this warrant must come largely from perception.

3. *Arguments against the coherence theory.*—This theory of the nature of truth is wrong in making coherence the

sole test of truth for the following reasons: (a) It has itself to admit one truth which is true not because of coherence with other truths, that is, it has to admit as self-evident the logical principle of consistency. (b) Some parts of our knowledge are more easily discovered and indeed were discovered long before other parts both by us as individuals and by man in the course of history, for example, matters of ordinary perception, and the simplest truths of logic and mathematics and many simple generalizations. It is inexplicable why one truth should be more easily discoverable than another unless we do actually perceive truths. (c) Moreover, these truths are not only easily discovered but they are the most nearly certain truths according to universal consent. Of them we can indeed say that they are held *semper, ubique et ab omnibus.* But why this should be so if the only test of their truth is that they are consistent with all else which we know, is hard to comprehend. So many truths which no one doubts and which are widely tested by their coherence still seem to us only highest probabilities and not certainties. Compare, for example, "the sun will rise to-morrow," with the percept, "there is no lamp on the table;" "a stone thrown into the air will fall" with "yellow is brighter than blue;" "all men die" with "there are precisely six combinations of three things taken two at a time." For ages some truths have been held to be necessary while all others have been called *contingent;* and this must point to a difference which indicates some original and direct access to truth. (d) Two sciences stand out *sui generis*, logic and mathematics. They are held to be infallible or infallible for

the greater part, or, if you prefer, all but infallible. How can this be when well-established sciences such as physics and chemistry make no such pretences? The perception theory can make reply but what can the coherence theory answer? (e) In general, it is evident that we learn through perception; and if we learn, what is there to learn except the truth of propositions? Every instance of exploration, geographical, geological, biological or of any sort, every instance of experimental research in the physical, chemical, or any other laboratory, every percept from the cradle to the grave, is either revealing truth, making us know more than we did before, or is testing what we already know by correcting or by supporting our working hypotheses. If such observation and experimentation have any influence upon our knowledge whatsoever, and influence every man admits that they have, what in the whole world of logic can be their influence unless it be that aforementioned? The only ways in which knowledge can be influenced are by increasing it, by correcting it, or by verifying it; and each of these ways implies that some as yet unknown truth is revealed. Hence if perception has any influence, it has this influence because it reveals truth. (f) Finally, if there is any other test of truth besides perception, any axiomatic rules, such as the principles of logic, these must be themselves either postulates or working hypotheses or else perceived truths. In short, perception is not only a test of truth; it is also the sole ultimate test of truth.

4. *Progress in perception.*—That perception is an ultimate source of truth does not imply that all men

are equal in their powers to perceive or that man's ability to perceive does not grow. Evidently the opposites of both these propositions are true. In the first place, the expert mathematician perceives with ease the truth of propositions which the idiot can never perceive or even understand. The musical can perceive harmonies and discords to which the non-musical seem completely deaf. The person with normal vision sees outlines and objects under conditions where the shortsighted person would be quite unable to see more than a blur of colors. In the second place, students of mathematics are conscious of growing insight as they progress in their subject; the musically trained perceive what is unheard by the musically ignorant; and in general, adults perceive far more than they were capable of perceiving when children. Thus, though the doctrine that perception is an ultimate source of truth, is a most democratic doctrine, giving each man, as a perceiver, a right to be heard and a right to judge for himself; still it is also an aristocratic doctrine, for it admits that the genius and the expert have a right to be heard and a right to judge where others have not this right.

5. *Empiricism vs. Rationalism.*—In deciding that perception is the ultimate test of truth we are prepared to take sides in one of the oldest philosophical issues, namely, that between empiricism and rationalism. We have already raised this issue, but let us now study briefly certain of its further aspects. In general, the problem involved is that of the source and certainty of man's knowledge, but the problem is analyzable into several distinct questions. On the one hand, empiricism

asserts that *sense* perception is our sole ultimate means of acquiring information and that consequently we cannot know more regarding the world than *sense* perception makes possible. On the other hand, rationalism asserts that besides sense perception we have another and surer means of gaining knowledge, our *thought* or rational insight, and that consequently we can know more than sense perception reveals and can know it with certainty. To the rationalist even from most ancient times mathematics has seemed the proof of his dogma. Here it is urged we have not only knowledge far beyond what sense perception reveals but knowledge which is infallible. To the empiricist all science, mathematics included, is but a generalization from man's particular experiences and is at best only of higher or lower probability. Such is the first question at issue between the two schools. This question I have already answered in favor of rationalism.

A second question arises immediately. If *sense* is our sole ultimate source of truth we can of course know no more regarding existence than sense perception reveals and implies. If however we can perceive universal truths, the hope is at once raised that we can know far more regarding the world and can know this infallibly. Perhaps we can perceive enough to know the general nature of the universe and possibly anticipate the most general results of inductive science. Perhaps too science can be deductive to a far greater extent than is at first apparent. Thus the second question may be worded: How far can we perceive universal truths and how far is our knowledge of existence infallible? The former

part of the question must be left somewhat open; but in general the strongest evidence goes to show that all attempts to deduce a theory of reality from so-called axioms or perceived universal truths has met with failure and will continue to do so. Again and again, what was taken to be an existential axiom has turned out to be not only a guess but a false hypothesis. So true is this, that modern science is thoroughly suspicious of any deductive existential theory. In general, then, we must decide that if we perceive universal truths; these are restricted to the principles of logic and mathematics and to such propositions as all reds are different from all blues, yellow is brighter than blue, pleasure is more desirable than pain. Such propositions quite by themselves give us little insight into the nature of the world total and certainly by themselves do not enable us to prove deductively a comprehensive theory of reality. Here empiricism is in the right.

In general, then, how far is our knowledge infallible? The answer to this question depends upon whether or not we do perceive universals. If we do, as I believe, perceive universals then such sciences as logic and mathematics may indeed be infallible. But if the principles of logic and mathematics are only generalizations from what we perceive, then the possibility is open that errors may obtain anywhere in these sciences. However, all propositions except what we actually perceive or deduce from what we perceive are tentative, that is, are hypotheses. They are not certainties. They are subject to correction by what we do perceive, and to-morrow's research may prove them false. Thus all information

as far as it is not perceived or deduced from what we perceive is got by the experimental, or trial and error method. This means that our whole world conception and the results of the sciences are only working hypotheses. Some of them are indeed far less venturesome than are others, come nearer to being verified than do others; but all involve guess. Yet they are not a mere guess, they are and have been subject to correction by an infallible test, the information revealed to us in perception, or the factual. Facts we do know; and this knowledge is gradually extending the remainder of our knowledge, and is constantly eliminating its errors.

FOR FURTHER STUDY READ:

Russell, Philosophical Essays, 150–185;
Russell, Problems of Philosophy;
Hume, Enquiry concerning Human Understanding, Sects. II–VII;
Hume, Treatise, Of the Understanding, Pts. I and III;
Mill, Logic, Bk. II, Chaps. III–VII;
Hobhouse, Theory of Knowledge, 483–516;
Read, C., The Metaphysics of Nature, Chaps. III–VI.

FOR MORE EXTENSIVE STUDY READ:

Joachim, Nature of Truth.

CHAPTER X

NOMINALISM VS. PLATONIC REALISM

1. The problem.—In an earlier chapter we defined existence as the true explanation of what we perceive, that is, as a theory which truly explains facts; and in succeeding chapters we enquired into the sufficiency and validity of theory in general. Now we are to enquire whether or not we have done rightly in defining existence so broadly, for we have made it almost synonymous with true theory. Two questions are involved. First, is not truth more inclusive than existence? Second, do universals exist?

2. Existence and subsistence.—The first question may be restated thus: Is there not information which is true but which does not assert itself as an explanation of facts, in other words, which is not existential? For example, the mathematician can demonstrate for us a non-Euclidian geometry as well as the Euclidian geometry which we learned in the elementary school. He can instruct us in the geometry of a four or n dimensional space as well as in the three dimensional geometry which we ordinarily believe to be the geometry of the space we perceive. Again, the mathematician can tell us truthfully much about perfect machines, or perpetual motion machines, although such machines may nowhere exist.

In general, logic and mathematics, including mechanics, can inform us, and inform us truly, regarding what is logically possible, although this information may not be true of the existent world. Hence, we must keep truth quite distinct from existence, and point out once more that the realm of truth is more extensive, including within it the realm of existence. The name given this larger realm is "subsistence" as opposed to "existence." Perpetual motion machines subsist, they do not exist. A four dimensional space may not exist, but it certainly subsists. All this is so, because any true proposition, or any entity or object concerning which we can assert a true proposition, is certainly not a mere nothing. As a genuine object of thought, it is, has being or subsists; and that it does not exist must not be urged against its having a place in science. We may then give the following answer to the first question: *The realm of subsistence is a more extensive realm within which is the realm of the existent; in other words, the existent world is only one out of many logically possible worlds.*

The second question raised regarding our definition of existence is: Should our definition be narrowed not only by excluding from existence all mere subsistents, but also by excluding all universals? In short, do universals exist or only subsist? This question regarding the existence of universals is a very old one and is one concerning which even now there is not consensus of opinion among philosophers. Those who answer that only particulars exist, are called nominalists. Some nominalists claim even that the subsistent is merely *words*. Hence the name, nominalist, from the Latin *nomina*. Those who

maintain that the universal does exist have been called *realists*. *Universalia realia sunt.* It is better to call them after the first great realist, Platonic realists. We have decided against the extreme nominalism which asserts that the subsistent is merely "convention" or "talk." The more moderate nominalism, however, raises an issue which we cannot dismiss so briefly and dogmatically. To this issue between nominalism and Platonic realism let us now proceed.

FOR FURTHER STUDY READ:

Russell, Problems of Philosophy, 127–157;
Russell, On the Relations of Universals and Particulars, *Proc. Aristotel. Soc.*, 1911–12;
Russell, Principles of Mathematics, 449;
Berkeley, Principles of Human Knowledge, Introduction, and Sects. 101–116;
Hume, Treatise of Human Nature, Bk. I, Pt. I, Sect. VII, Of Abstract Ideas;
Mill, Examination of Sir Wm. Hamilton's Philosophy, Chap. XVII, The Doctrine of Concepts, or General Notions;
Perry, Present Philosophical Tendencies, Chap. X.

3. *A defense of Platonic realism.*—In discussing this issue I shall try, as far as I can, to reconcile the two doctrines. (a) The nominalist is correct in combating the extreme realism which has, probably wrongly, been ascribed to Plato. The entities and the propositions of logic and mathematics, the generalizations of natural science, such as the law of gravitation, do not exist in the same way as does St. Paul's Cathedral, the Amazon river, or the planet Jupiter. The laws of nature, that is, the universal propositions by means of which we explain facts are not entities that we can meet on the

street and with which we can shake hands. They do not exist in any place or at a statable time. They are eternal, that is, timeless. They are spaceless, that is, they cannot be located.

(b) Yet it would be equally erroneous to go to the other extreme and to maintain as a nominalist that only things which have a duration and occupy space, exist. For how about time and space themselves and how about many of the relations between things? Surely we perceive relations as truly and readily as we do the things between which they obtain, and many of them are not located in time or space. For example, I can perceive order, the order of the fingers on my right hand and its difference from the order of the fingers on my left hand. I can perceive the relations between the colors, between musical notes, between weights, between odors. Such relations as these last are not temporal or spatial. Then too, many of the relations which we perceive are elementary features of space itself and as such should be said to constitute space rather than to be located in space. In short, it would be idle to maintain that relations are nonexistent; and once we admit that relations exist, we are a long way toward realism.

Of course it will be objected that admitting the existence of relations is admitting only that the *particular* relations exist, the relations actually perceived holding between the particular entities. But let us see if further considerations do not force us to admit that universal relations exist. We can perceive the likeness between twins. But once we admit this, can we deny that the zoölogist sees the likeness between lions, tigers, panthers, wild cats,

leopards, lynxes, which he calls "Cat" (*Felis*)? This likeness certainly exists. Moreover, it is not the particular likeness between one tiger and one leopard and between one leopard and one lynx and so on through the list taking the millions of specimens two at a time. The likeness is a *universal* likeness between cats in general. The nominalist will hardly object to the biologist saying, "There exists a likeness between the members of the genus *Felis*," or to his attempting to explain the origin of this likeness. Therefore, some universal relations exist.[1]

The existence of laws of nature has been called in question especially by two prominent living nominalists, Professors Mach and Pearson. According to these philosophers, natural laws are but brief descriptions or conventions whose entire significance is their economy for our thought. There is no such thing in nature as the law of gravitation. There are only falling bodies, and the law of gravitation merely sums up for us in one exceedingly useful statement the countless instances of falling by describing certain important common characteristics. In short, the laws of nature are human inventions, human devices, and belong as little to the physical world as does the English language or as do the names of the stars. But such a doctrine is hardly fair to the truth, for it does not

[1] It is true, this problem can degenerate into a question about the use of words; and we must be careful to keep it from doing so. Existence can be so defined that relations and universals are excluded; and if it is a desirable usage to adopt this definition, the realist should yield at once. All I wish to maintain is that the line between the existent and the non-existent will then be a very narrow one, and it seems to me a thoroughly arbitrary one.

explain how these mere conventions can be so exceedingly useful and trustworthy or how they came into man's possession. It is not fair to say that Newton *invented* the law of gravitation; rather we must say he *discovered* it. Moreover, the laws which science teaches are either true or false and, by this we mean, that they do explain or fail to explain facts. The law of gravitation explains facts for in part through it we can deduce a host of familiar verifiable events. Were it a mere convention, such powers would be no less than miraculous. Now in asserting the existence of this law all that a critical realist means is simply this: the law is a genuine discovery and does explain fact.

Again, according to these philosophers, perceivability is the sole criterion of existence; and if so, both laws of nature and such hypothetical imperceptible entities of science as the chemical atoms, the electrons, and the ether, cannot be said to exist. But it is hard to believe that these philosophers see the full implication of their doctrine. In an earlier chapter we have seen how few things are really perceivable. Our bodies, our houses, our country, have never been perceived; and certain it is that the earth and its rotation have not been perceived. Do they then not exist? It is preposterous to make the limits of human perception the limits of existence! Moreover, perception is a treacherous criterion for a nominalist to use as a criterion of existence, treacherous because it may be that we can perceive things which all admit merely subsist and things that are decidedly universal. In short, if perceivability is the criterion of existence it must be both limited and extended to fit the existential beliefs of the nominalist or of anyone else.

Hence when it comes to the question whether or not such imperceptible entities as the chemical atoms and the ether exist, it is the same type of question precisely as the question, does the earth exist? It is a question as to whether or not these entities explain certain facts and remain consistent with all other facts. That they are imperceptible has nothing to do with the case, except that verification may be more difficult, or that we shall have to wait longer for it.

Finally, two further matters mislead these nominalists. First, sometimes more than one law is discovered which will explain equally well the same facts, and it seems to the nominalist impossible that reality can be thus multiple. Regarding this I know of but two things to be said. First we have no guarantee that further research and exploration may not at any time provide a crucial experiment between such theories or even prove both theories false: and we have no absolute guarantee that existence is single and not multiple. Existence as far as we know it seems to be single but it may be that the facts about us belong to two or more worlds. That is, there may be two theories both of which are consistent with all facts and both of which explain certain facts, and there may be no crucial test between them. If this should be the case anywhere, what possible *a priori* proof have we that both systems do not exist? Of course, such is not our working hypothesis; but it fails to be our working hypothesis not because we know it to be false, but because crucial experiments have so often decided in favor of one or other rival theory.

The second matter which misleads the nominalist, is

the fact that scientific theories keep coming and going. For a while a theory is widely held and seems to explain the known facts; later newly discovered facts make it obsolete. This leads the nominalist to ask, Can such entities exist? Of course not. Later discoveries showed that they were not truly laws of nature. The realist maintains only that the *true* laws of nature exist. "But how are we to ascertain what are the true laws?" Of course only by methods that do not give us infallible results and hence both nominalist and realist may agree that we do not know absolutely any given theory to be the truly existent law of nature. "Why then not admit that the so-called laws are *merely human ways* of explaining?" Because they are not asserted as merely human conventions but as true laws of nature which the discoverer would reject if any crucial experiment decides against them. Notice, moreover, that even the assertion that this or that particular and theoretically perceivable event exists or existed, is often no better off, as far as our knowledge is concerned, than are these laws of nature. Thousands of particular existential propositions are entertained by men regarding the remote past which cannot possibly be directly verified. They might have been verified by perception had we been there; but now they are (for human knowledge) only theories to explain facts we do perceive. Such, for example, are the various assertions in the geological history of remote ages. In short, the fact that we cannot absolutely verify the existential theories of science does not imply the nonexistence of those laws; it simply indicates the tentative character of human knowledge.

FOR FURTHER STUDY READ:

Russell, Problems of Philosophy, 127–157;
Sheldon, The Metaphysical Status of Universals, *Philos. Review*, 1905, *14;*
Pearson, Grammar of Science, Pt. I, Chap. III, The Scientific Law, also Chaps. VI and VIII;
Mach, Science of Mechanics, 481–494, The Economy of Science;
Le Roy, Science et Philosophie, *Rev. de Métaph. et de Morale*, 1899, 7.

FOR MORE EXTENSIVE STUDY READ:

Plato, Republic, esp. Bks. VI and VII;
Plato, Theætetus;
Plato, Parmenides;
Stewart, Plato's Doctrine of Ideas;
Poincaré, The Value of Science;
Mach, Analysis of Sensations.

4. Conclusion.—The realm of subsistence and of truth is a broader realm than is the realm of existence. The world is only one of, it may be, an indefinite number of logically possible worlds. This realm of subsistence is a genuine field for scientific research even though it is true that existence interests us far more than what might have existed and that we study the subsistent chiefly with the hope of gaining further knowledge regarding the existent. The laws of nature and other universals and again the hypothetical entities of science are existential. Their logical status is radically different from that of mere conventions or practical instruments. They are asserted as explanations of fact, and if they are indeed such, then they exist as truly as do the hypothetical particulars whose existential character no one questions.

CHAPTER XI

CAUSATION

1. *Introduction.*—The problems of the nature of explanation, and of the status and perception of universals, lead us to another fundamental problem. Tentatively expressed this problem is, how can we learn from one part of the world truths regarding other parts? For example, how can we learn from what is happening near us, what is happening far away? How can we learn from present documents, relics, ruins, and fossils, the story of past ages? Surely each particular fact is merely witness of itself and tells no story regarding any other fact; for did it we should never be at a loss regarding the distant, the past and the future. The ignorant and thoughtless could then look at a stratum of rock, at a fossil, at a ruined wall, at an old manuscript or inscription, at a footprint, or at any other fact, and know directly the past to which it is related: whereas the truth is, the fire does not tell the babe that it will burn and destroy; nor does the falling barometer tell the ignorant of the approaching storm. With outside information, however, the astronomer observing the heavens can foretell the coming eclipse, the mariner taking the temperature of the sea water can sometimes be forewarned of approaching icebergs, the naturalist coming upon fossil remains can decide the age of a rocky formation,

the physician watching a patient can assure us of his recovery.

We have to have outside information. But what information? *That a given proposition implies this or that further proposition.* In other words, were it not an ultimate trait of reality that one proposition implies further propositions the only mind that could discover or know any truth would be the mind by which the truth is actually perceived. But it is a fundamental premise of science, and a part of every theory of reality, that propositions do imply one another. This premise is ultimately what we mean by causation, by the statement that the world is a causal system, a system in which law reigns. Yet it is conceivable that truths should be so completely disconnected that they would not imply one another, that one truth would not indicate any other truth. If this were the case, truths would not form a system but chance alone would reign; for after all we mean by an event due to chance a proposition whose truth or falsity is not deducible from other known propositions.

The problems of this chapter are the following: (a) Is causation always reducible to implication? (b) What are the different types of causes? (c) Is science tending to reduce the multitudinous causes to one cause, that is, is the world the product of one cause or of many ultimate independent causes? (d) Is chance as well as causation present in the world?

2. *Causation reducible to implication.*—Perhaps the oldest conception of causation held by man is one derived from two types of experience. The first type of experience is the feeling of helplessness in overcoming

or resisting the obstacles to our will. We are carried or pushed, or struck, or burned, or disappointed, and are unable, in spite of our utmost resistance, to prevent things having their way with us. The second type of experience is our feeling of ability to control these agents and to have our way. We can move them, stop them, push them, throw them, or in some other way determine their behavior. These two types of experience led men at first to picture causation in terms of the sensations and feelings which form so noticeable a part of our efforts. A cause is an "active," a "striving," "struggling," "compelling," even "living" and "willing" thing. It has "force" or "power" by which it "necessitates" the outcome. Indeed, only in modern times has it become clear that this is not causation as causation should be defined in science; for it was not until the great English philosopher David Hume (1711–1776) submitted our notion of causation to a rigorous analysis and scrutiny that the irrelevance of this animistic causal conception became fully apparent.

Causes do not reveal to us a striving, a power, a will, a necessity, or anything of the sort. Rather what we observe is one event succeeded by another event, or one thing changing as another thing changes, or one thing present when another is present. For example, one billiard ball hits another, and then this moves. The temperature rises and the ice melts. We oil the axle and the wheel makes more and quicker revolutions when given the same push. We open a cock and the water flows from the tank. We close a wire circuit and the electric bell rings. Even in the case of our own conduct

the feelings of effort and power are not always present; and where they are present, psychology and physiology show that they accompany rather than constitute the cause. Hence, if we talk of the "necessity" of the effect following the cause, or if we ascribe to the cause a "power" or "compulsion," these words, to be true to fact, must take on a different meaning, a meaning which we shall see they may be given when used as logical notions. Necessity must mean logical necessity. The power of the cause must mean logical power. But what is logical necessity and what is logical power? Logical power between one proposition and another can be only another name for implication; and logical necessity can only mean that one proposition is logically prior to, that is, is presupposed by, another. In other words, science seeks logical relations, relations by which from one proposition it can infer other propositions, and these are the causal relations. How much more may be existentially involved when one event is caused by another is of course not only a legitimate problem but one which science cannot ignore. Causation, however, is a far more general and abstract aspect of the world than, and is logically independent of, any animistic or similar hypothesis. As a notion in science it is that relation between entities or between the relations of entities which enables us to know one when we know the other. In short, causation is implication.

This reduction of causation to implication shows that many other typical features of the causal process are irrelevant, and that they should not be included in its definition. (a) We usually think of the cause as a

temporal antecedent to the effect and of course it is often such; but *this temporal antecedence is not essential to causation.* Sometimes cause and effect are contemporary as in friction impeding motion. In mechanics, from two or more configurations of a system we can deduce backward as well as forward in time and ascertain further configurations. In this case there seems no better reason for saying that the cause precedes the event than for saying that the event precedes the cause. Thus, when the astronomer observes with precision a few positions of a comet and the time of these positions, he can calculate the path through which the comet has been travelling as readily as the path through which it will travel. (b) Then again, in some cases *time seems altogether an irrelevant aspect.* Thus the property of an object often depends upon a geometrical property and conversely this second upon the former. For example, the shape of an object may have much to do with its behavior. The shape of a tank is the cause of its holding more water than another tank constructed out of the same amount of material. The angle of an inclined plane causes the greater or less velocity of the object rolling down it. The position of a fulcrum causes a lever to work successfully whereas another position would cause it to fail. The shape and size of a wheel are as truly causes as is the horse which draws the cart. The shape of the path of a comet determines whether the comet remains in our solar system or leaves it never to return.

FOR FURTHER STUDY READ:

Hume, An Enquiry Concerning Human Understanding, Sects. II–VII; or

Hume, A Treatise of Human Nature, Bk. I, Part III;
Mill, Logic, Bk. III, Chaps. III–V, XXI and XXII;
Venn, The Principles of Empirical or Inductive Logic, Chaps. II–V;
Erdmann, Content and Validity of the Causal Law, *Philos. Review*, 1905, *14;*
Thilly, Causation, *Philos. Review*, 1907, *16;*
Pearson, Grammar of Science, Vol. I, Chap. IV, Cause and Effect, and Chap. V, Contingency and Correlation;
Russell, Principles of Mathematics, Chap. LV, Causality;
James, Some Problems of Philosophy, Chaps. XII and XIII.

3. The different types of causes.—If causation is reducible to implication then the only causes are propositions; and the question, What are the different types of causes? reduces to the question, What types of proposition are found in causal implication? Evidently universal propositions as well as particular propositions are found here. Thus there are two major types of causes, universal causes and particular causes. The universal causes include what are familiarly called the laws of nature. The particular causes constitute the world of things and events in time and space.

These particular causes form the logically lowest level of the universe. Logically above them are levels of universal causes, as we ascend to propositions of greater and greater generality. From laws that hold of very complex particular objects such as society, minds, animals, we ascend to laws that hold of all life, from these to laws that hold throughout the chemical world, from these to laws that hold of the physical world, from these to the mathematical laws and from these to logic. In this way, the scientist has always striven to discover more and

more general laws from which he can deduce the less general laws already known or under which he can classify them; and it is in this way that he hopes ultimately to unify all that we know.

This hope has raised two philosophical problems: First, cannot all causal laws be ultimately brought under one universal law? Is there not one ultimate law or proposition which forms the head of the hierarchy? Secondly, cannot all the less general laws down to the particular propositions which constitute the world in time and space be deducible from this one highest law? The belief that this can be done may be called Causal Monism, and the contradictory belief, Causal Pluralism.

4. Causal pluralism.—Evidently the principles of logic form the head of the hierarchy, for they are the most general laws. To infer from this, however, that logic contains all the logically primitive notions and propositions of science, would be the grossest of errors. Each existential science brings in new terms and new relations that are either quite indefinable or indefinable in terms of pure logic. For example, in terms of logical notions, it is impossible to define animal, water, red, or most of the terms and relations found in the special sciences. Again, each existential science brings into the argument new propositions that cannot be deduced from logic. For example, the law of the inertia of matter, the composition of water, the laws of living matter, are indubitably beyond such deductions. If this is true of the more general propositions and notions of physics, chemistry, and biology, how much more evidently is it true of the infinitude of particular proposi-

tions which form the logically lowest level! These particular propositions cannot be deduced even from the less general propositions which stand closest to them. For example, no psychologist could deduce the biography of a man from general psychology. No breeder of animals could deduce from mendelism all the traits found in a given litter. No physicist could deduce from general physics whether a tossed penny will fall heads or tails. In short, the particular entity seems infinitely complex, baffling all attempts to put it completely under any assignable number of laws; and this means that each particular thing and event is itself a logical ultimate, or primitive.

Let me illustrate this important point. From physics I may know the general path of a projectile leaving the earth at a given angle and at a given velocity. But other factors, perhaps countless other factors, enter to alter this path in any actual instance; for example, the currents and changing density of the air from point to point, the minute immeasurable variations in gravity at different points on the earth's surface, the changing shape, surface and rotation of the projectile itself. As a second illustration, think of the countless factors which enter into the growth of a man's body and mind. Every meal he eats, every act he performs, every experience he meets, each has some influence. As a further illustration, think of the countless factors which influence the social and political history of thousands and millions of these men. So numerous are the factors which influence each entity that it is highly probable that no two men have ever been alike, no two animals, no two

plants, or no two grains of sand. Indeed may we not go farther and ask, are there even two atoms of oxygen alike, or any two particular things alike? Again consider the unlikeness of events. If a man is shooting at a target, no matter how many shots he takes, does a second bullet ever hit quite where another has? Does a river ever flow two moments in quite the same channel? To these and similar questions one can only reply: Where we have been able to examine or to measure with sufficient accuracy, we find always what we find when in a crowd we look at different faces, *no two alike.*

Thus it seems that general laws can never be the complete explanation of any particular thing or event in the world about us. The infinite number of particular propositions may form each a part of the world's explanation and each may be as truly ultimate as are the very principles of logic. Hence from the standpoint of causation the world has an infinitude of ultimate and independent causes. They are ultimate and independent because no amount of knowledge of other details of the world would furnish us enough information from which to deduce this total nature. Another way of stating this point is that the world might be indefinitely different from what it is in these particular propositions without requiring any change in the general propositions, and the less general propositions might be different without the more general propositions being false. Still another way of saying the same thing is, the world of particulars is only one out of (for all we know to the contrary) an infinite number of logically possible worlds.

5. *Chance, or spontaneity.*—The world cannot be ex-

plained solely in terms of general causal laws, but it is rather a world of causal law and of particular individuals. Expressed from the standpoint of causation, it is a system in which, in all particular objects and events, chance is present, chance meaning any feature or term of a complex object or event which cannot be deduced from general propositions or laws. We can foretell that a penny will fall either heads or tails, but from what we know beforehand we cannot ascertain which; or we may know the average of a class or species, but we must depend upon actual perception to ascertain the complete nature of each individual member and his variations from the central tendencies of the group. That is to say, each particular thing or event contains particular propositions which defy deduction and which therefore are logical ultimates; and such propositions have to be learned empirically by examining the thing or event itself. All of this can be expressed in the more pictorial though less rigorous language of biology. A cause, or an action of one entity upon another, is a stimulus. The stimulus accounts for the reaction only to a very small extent, because the nature of the individual organism itself plays by far the greater rôle.

(SECTIONS 4 AND 5) FOR FURTHER STUDY READ:
Mill, Logic, Bk. III, Chap. XIV;
Peirce, The Doctrine of Necessity, *Monist*, 1891–2, *2;*
Sheldon, Chance, *J. of Philos., Psychol., etc.*, 1912, *9.*

FOR MORE EXTENSIVE STUDY READ:
Ward, Naturalism and Agnosticism, Pts. I and II;
Perry, Present Philosophical Tendencies, Chap. IV.

6. Conclusion.—Thus the study of causation reveals to us a picture of the world as a twofold causal system, on the one hand a system of universal causal laws and on the other hand a world of ultimate individuals or particular complex entities. The scientist is engaged in the discovery of the universal or general laws. Starting with more general laws he deduces subsidiary laws, or starting with less general laws he generalizes and thereby discovers the logically higher laws. By this twofold method he seeks to deduce as far as possible the individual or particular existent entity or event, that is, the particular propositions which constitute its nature. The hope of carrying this process farther and farther is ever before him and raises the still greater hope that the goal is attainable where all the world will be found to be deducible from the system of causal laws, or from the system of causal laws and some minimum assumptions giving the particular nature of the existing entities. His ideal then is a monistic causal system, and rightly so, for only research itself will ever tell him how far the world is a world of universal causal law; but meanwhile his actual experience seems to be indicating that somewhere there is a limit to such law.

This limit may be conceived in two ways. First, it may be simply the end of an infinite series in which from higher laws he proceeds *ad infinitum* to laws of less generality until the complex nature of the individual at infinity is completely deducible. If this conception be correct, his present and future failures are due only to the impossibility of exhausting an infinite series inductively. Secondly, the limit may be conceived as absolute

and probably not infinitely distant, where part of the individual's nature has to be accepted as peculiar to it and as logically ultimate. Though no conclusive proof is in our possession as to which of these two conceptions is the correct one, the evidence which we have all points to the existence everywhere of unique individuals whose particular nature is logically ultimate. No doubt analysis can carry us indefinitely farther than we have gone if only we discover the means; but wherever we do succeed in analyzing farther the causal laws at work in the individual entity or event, it is only to find again at a lower logical level the idiosyncracies of the complex individual. For example, it looks as though after we have analyzed different chemical compounds and have found in them the same chemical elements, we should find the atoms of these elements unlike one another if only we could examine them as we can examine individual human beings. And if in turn we could analyze these atoms into electrons, it would only be to find again differing individuals. Of course, this example is mere speculation, but it is commonplace information that wherever we are able to study individuals minutely we never find two alike. Hence causal pluralism seems the better hypothesis.

If this hypothesis is true, then there is a goal for science in her search for causal law, a goal where the individual is taken as logically ultimate or rather where we analyze its complex nature into its unique particular propositions, which cannot be deduced but have to be empirically discovered. We seem to know an indefinite number of such particular propositions already, the "finger prints"

of individual realties. They form the class of particular perceived propositions, or particular facts, as opposed to all universals perceived, inferred or assumed, and as opposed to all particular propositions deducible from these universals.

CHAPTER XII

TEMPORALISM AND EVOLUTION

1. *Two problems.*—In explaining fact man has discovered a causal world-system extending through time, past, present and future. For example, the geologist finds far inland the deposits made at the mouth of a river untold ages ago. He sees to-day other rivers, such as the Mississippi, carrying down sediment and depositing it in the ocean and thereby gradually building mainland that is to be ages from now. Similarly everywhere what has existed and what will exist are logically as truly present to be known and studied, to imply and to be implied, as is that which we call the world of to-day. Therefore, regarded strictly from the point of view of formal logic, time is a secondary feature; the whole world, past, present and future, is given as one eternal or logically present system. Yet the question arises, Is not such an eternal, or timeless world but one aspect of a world far more complex? Is not time, with its distinction of past, present and future, not only a genuine aspect of reality but a fundamental aspect? The doctrine of those who reply, "No," is called Eternalism; and the doctrine of those who find in time a fundamental trait of the existent is named Temporalism. The issue between temporalism and eternalism is our first problem.

To this problem a second problem is intimately related. The future brings with it not only particular objects and events that have not previously existed but also objects and events whose nature is thoroughly novel and unique. It is said that history repeats itself; and of course in some respects it does; but, when we come to particulars, history seems never to repeat itself, for the new period or age is always unique and novel. So too as we go back into the remote history of the human and the animal races, we learn from biology how new forms of life have constantly been arising on this earth: and might we go back to the origin of life, the origin of the more complicated chemical compounds, the origin of the earth and solar system, and the origin of the chemical elements themselves, and might we study each particular thing, we should probably find everywhere the same story, each stage of the world's history is marked by the arising of the new and the unique.

The preceding chapter has pointed out to us this aspect of the world, which we there called chance. The universal propositions do not give us enough information from which to deduce the particular existential propositions; and a collection of particular existential propositions, for example, a detailed account of some past epoch in the earth's history, does not give us information from which another similar collection of particular existential propositions, some later epoch, can be deduced. A rigorous way in which to express this causal pluralism is, the facts are constantly revealing particular propositions which are logically ultimate or primitive. Of course, this does not mean that every particular propo-

sition is logically fundamental, but that the logically new is to be found in all facts. If now we think of this causal pluralism related to the world in time, we shall see that some particular propositions are not only logically ultimate but that these fundamental particulars are related to each instant of time, such that each instant has its logically primitive aspect. Expressed in other words, related to each instant of time there are particular propositions which could not have been deduced from the past, even were our knowledge of the past and of the universal propositions complete. The deduction would require as part of its assumed premises these very particular propositions which are in question. For example, could a mind of superhuman wisdom have seen and have studied fully this earth and life upon it back in the carboniferous age, he could not have deduced that you and I would be living here to-day. This doctrine that each stage of history brings with it logical ultimates, may be called the doctrine of evolution, or more explicitly, of creative evolution.

In opposition to this doctrine the believer in causal monism or in eternalism would maintain that the whole future universe can be deduced from a complete knowledge of its universals and of a few of its stages. As the mathematician can deduce all the values of a variable from an equation or as the student of mechanics can deduce from two configurations of a closed mechanical system all its past and future configurations, so a superhuman intellect with full insight into the past could deduce the future. The issue between the believer in creative evolution and the eternalist constitutes our second problem.

2. *Temporalism.*—Both issues take us beyond logic and force us to appeal to fact. As far as logic is concerned, time could be an eternal, logically present, dimension of the world. Indeed time is such a dimension in abstract mechanics. But the complex facts of the concrete existent world seem decidedly to favor temporalism. Our actual temporal percepts lead all men to entertain the temporalist hypothesis, at least in matters of daily life, where metaphysics has not made them sophisticated.

The hypothesis that accords with the facts we actually perceive, includes two most significant and fundamental elements. (a) The temporal order of events is absolutely asymmetrical. That is, it has a fixed direction which cannot be reversed. In space an object can move from right to left and back from left to right; but in time we observe facts in a fixed order in which the present succeeds the past and the future succeeds the present.

(b) The existential status of the present is fundamentally different from both the past and the future. The past tense and the future tense of the verb to exist indicate more than merely different points in an asymmetrical time series. They indicate a further ultimate trait of observed fact, that the future existent is inferred, whereas the present existent can in part coincide with fact. For example, as I observe the facts called "the noise of the wind blowing" I interpret, or explain this fact, by asserting the proposition "the wind is *now* blowing;" and though I may believe that the wind will continue to blow, I perceive that I have far fuller warrant for the proposition "the wind is *now* blowing" than I

have for the proposition "the wind will blow." Similarly, the factual evidence for the proposition "I now exist" is far fuller than for the proposition "I shall be alive ten minutes from now." Why? Well, this also is an ultimate, a fact, a perceived truth. Notice further that it is more than an uncertainty regarding the future. It is an actual coincidence in part of fact and present existence. I never perceive to-morrow but I do perceive what I interpret to be the present.

More difficult to discover than the status of the present or future is the status of the past. Is the past ever perceived or is it always inferred? Is memory ever perception or is it always inference? This question is a difficult one, for what we ordinarily call memory is proverbially fallible; and yet at times our memory approaches complete certainty. For example, immediately after reading the previous sentence, are you not certain that you did read it? However, the past soon becomes a matter solely of inference, and it is always so where memory leaves us ignorant. Still, the past has existentially a different status from that of the future. Let us suppose that a man is totally lacking in memory and that in observing the facts we call the present he comes to the hypothesis of a past and future world as he might to an absent or distant present world. The past would be fully an inferred, not a perceived, existent; but would it not belong to existence in a radically different sense from that in which the future does? That is to say, do not the discovery of America, the battle of Waterloo, belong to reality in a way in which our death, our great-great-great-grandchildren, the extinction of the human

race, the collision of earth and moon, do not? This difference can be expressed by saying, the past *has* existed, the future *has not yet* existed. But to what does this difference ultimately go back? Not to a logical difference, for the past and future are both parts of one series, and logically their difference is solely one of position. No, the difference is an ultimate matter of fact. *The past has been a present, and any present has a status, or can have a status, which we call perceivable existence.*

This status we believe to be due not merely to the limits of the human powers of perception, but due to the nature of the real itself. *We do not perceive the future because the future as such cannot be perceived.* Of course, we have no complete proof that minds do not exist which can perceive the future, but we have as much evidence for this as we have for most hypotheses. As we know fact, the future is not and never has been fact. That is, as far as we know, even a mind of far higher powers of perception than ours would have to infer the future and could not literally observe or perceive it. *Factually the future is not present to be perceived.* Whereas the past might be perceived by a memory of a higher power than man's and in part is (probably or at least possibly) perceived even by man. To repeat, that the future "does *not yet* exist," is not due to the limitation or the imperfection of our perception but to the nature of the real.

This temporalism is forced upon us by fact as we know it, and not by theory. For theory the future is as genuine a part of existence as is the present, and all time is logically present. That is, our earlier definition of existence, as the complete explanation of fact, still

stands; but it defines existence in the broadest sense of the word; for it includes both the past and the future tense of the verb to exist. Fact, however, compels us to give the present and past a different existential status from that which we give the future. Ordinarily we express this difference by saying "the future does *not yet* exist;" and in so doing we give the word exist a narrower meaning. As it will be confusing to use the word exist in two senses, let us retain the original definition and use for the narrower meaning the expression "to exist as fact."

The temporalist's conception of existence, put in more concrete and pictorial terms, is somewhat as follows: The existent actually grows or buds. It is like an on-moving wave. The future is born of the present and past. It is now potential, not actual. It evolves out of the present. Evolution is an ultimate trait of existence.

FOR FURTHER STUDY READ:

Lovejoy, The Place of the Time Problem in Contemporary Philosophy, *J. of Philos., Psychol., etc.*, 1910, VII.

FOR MORE EXTENSIVE STUDY READ:

Bergson, Time and Free Will;
Bergson, Creative Evolution.

3. *Evolution.*—The world is a growing world, not only in the sense of temporalism but also in the logical sense aforegiven. The future brings with it not only that which could not be observed but also that which could not be deduced, and therefore that which could not be predicted, or previously known. The entire past can,

theoretically, be known by inference and by memory; but the future can be known by inference only in part. Logically there is no reason why the world should not be a continued repetition of the elements, or ultimate particulars, which make up the past, either in new combinations or in the same combinations, as the one play may be acted at a theatre on many successive days. But, as far as we know, the world is not such. New things, new events, and perhaps even new elementary constituents of these things and events, are *potentially* in the present. This fundamental newness, and the resulting impossibility of knowing the future fully may be called freedom or spontaneity, or better, creative evolution. Rigorously defined, creative evolution is the truth that some particular existential propositions related to future instants are not so related to past instants and that these propositions are neither deducible from universals or from the past, nor knowable beforehand in any other way.[1]

FOR FURTHER STUDY READ:
Woodbridge, Evolution, *Philos. Review*, 1912, *21*.

FOR MORE EXTENSIVE STUDY READ:
Bergson, Creative Evolution.

[1] To some readers this conclusion may seem to conflict with my definition of the world as the complete explanation of fact; but I do not think that it does. It shows, of course, that the world is to a certain extent unknowable at the present time. The facts force us to infer as their complete explanation an evolving world; since they require for their complete explanation ultimate particular propositions. That is, the at present unknowable part of the world is assumed by us to be an evolving existent because only this general assumption explains the facts we do know.

CHAPTER XIII

THE LOGICAL STRATA OF REALITY

1. *Introduction.*—In the preceding chapter we studied the general notion of evolution, finding spontaneity or creative transformation a prominent characteristic. We have now to study a further characteristic which many scientists would single out as the most prominent feature of evolution, namely, its historical continuity, or, more precisely, its logical continuity. It will be recalled that by logical continuity is meant the opposite of spontaneity. In other words, the logically continuous can be deduced from the historically antecedent. The clearest examples of such continuity are successive configurations of purely mechanical systems. Thus the successive positions of the planets of our solar system can be deduced from the previous configurations of this system.

If we emphasize this characteristic of evolution we see in the new thing or event the logical consequent of its antecedents and we are led to maintain that the chief business of the student of evolution is to discover in each stage of history the sufficient reason for the following stage. To such a student evolution does not mean the arising of the new but the continuation of the old. Let us take a concrete and familiar example. The evolution of life on our planet will mean to such a student chiefly two things: first, the chemical-physical continuity of

the living creatures with the inorganic world out of which life is believed to have originally sprung and out of which it is constantly springing through the absorption of heat, light, water, and the various chemical compounds forming the food of plant and of animal; second, the continuity of structure between the offspring and the parents.[1] According to the first meaning which evolution has to the student of life, the living creature is an exceedingly complicated chemical-physical machine to be explained by means of the laws of chemical synthesis. It does not present anything radically new which would take the student of life beyond organic chemistry and other branches of physical science in order to explain; for the living thing is continuous with the inorganic world in the same fundamental sense as is a crystal or any complicated organic chemical compound. In short, life could be deduced from chemistry and physics if those sciences were complete. According to the second meaning which evolution has to the student of life, the living organism is but the result of a new combination selected out of the Mendelian characters of his ancestors. It may owe the color of its fur to one grandparent, and the shape of some particular member to another, and so on through the total list of its unit characters.

There is no doubt that it is preëminently the business of science to discover this logical continuity in the successive stages of existence; and no doubt the logical continuity is there ready to be discovered, so great has been the success of science in the past in discovering instances of this continuity in almost every domain of

[1] Cf. Chapter XXI.

reality. But this very success can easily lead the scientist to the doubtful conclusion that all elements of existence are logically continuous with one another and with the past. The purpose of the preceding chapter was to point out and to emphasize the logical discontinuity of the evolving existent; and the purpose of the present chapter is to point out the relation between this logically discontinuous and the logically continuous sought for and in part discovered by science.

2. *Logical continuity and discontinuity in reality.*—It would take us quite beyond general metaphysics and into the detailed results of the special sciences if we sought out all the fields and levels of logical continuity. Some instances of continuity, however, are both prominent and familiar, and it will fulfil our purpose if we keep to them. Every student of physics is aware of the wonderful rôle played by applied mathematics in this science, that is to say, the remarkable extent to which many physical theories can be deduced mathematically from postulates. This is true not only in the narrow field of mechanics which is strictly only a branch of mathematical science but also in the fields of such non-mechanical energies as light, heat, and electricity. Yet even in physics where logical continuity is apparent, discontinuity also is apparent; for the hopes entertained by earlier generations of making all of physics deducible from mechanics seem now ungrounded. But even if physical science could be reduced to mechanics, this would not eliminate the presence of discontinuous elements, rather it would make their presence more evident. The facts which the physicist studies in his laboratory and

upon which all his theories depend for their verification are radically unlike one another and clearly different from the terms of the theories by which he explains these facts. For example, he may trace a logical continuity between undulations in the ether and the properties of the light which he observes. Yet light *as observed* is not an undulation; it is just light. Heat again, the heat with which he is actually experimenting, the heat phenomena by which he actually verifies his hypotheses may be logically continuous in many of its aspects with the mathematical postulates and hypothetical entities which serve to explain it; but on the other hand it is evidently unlike them. So decidedly is this the case that even physicists of renown differ radically regarding the existential status of these postulates and entities; and all would admit that we are far nearer certainty in asserting the existence of light than we are in asserting the existence of the ether or of undulations in the ether; and again that we are certain of the existence of electricity, whereas our assertion that the electrons exist is at best only highly probable.

A similar situation meets us in chemistry. Through the atomic and molecular hypothesis and through the discovery of the elements we can trace the chemical continuity between substances before and after chemical reactions. Yet how utterly unlike these chemical compounds are! One may be a high explosive, a dangerous poison, a transparent liquid, a red powder, a highly volatile oil, or a substance with a remarkable list of chemical affinities for other substances; whereas the other may have quite an opposite character. Of course,

the extent to which such traits may some day reveal far more logical continuity is to be learned only by further research; but from past experience it is probable that with an increased knowledge of continuity we shall still have the discontinuous facts of our present perception and even additional ones revealed to us by more delicate experiments and instrumental devices.[1]

A similar truth is found when we examine the biological and the psychological. With increasing complexity of parts and structure the animal world reveals widely different and novel characters. Even should it some day be possible to work out in utmost detail, let us say in terms of the inheritance of unit characters through a continuous germplasm, the continuity of characters from generation to generation; still we shall not get rid of spontaneity, or creative evolution, for each of these unit characters has its date of first appearance in the history of the given race. In such cases, no doubt, the origin of the trait may be in part chemically continuous with its antecedents whatever they may have been, but to show this would only bring our problem back again to the discontinuity within chemistry and physics.

In the case of consciousness much ingenuity has been at work to get rid of the evident discontinuity in the known facts of the origin and development of mental life. And however correct the resulting theories may be in getting rid of part of the discontinuity, the remaining discontinuity does not become less evident. Some theories would ascribe even to the chemical atom and nowa-

[1] Cf. Chapter XX.

days would have to ascribe to the electron and the ether some sort of consciousness; whereas facts apart from theory suggest that consciousness is a relatively recent character in the earth's history. Still, whether consciousness is present only in the higher animals or not, every adherent of complete continuity faces the same difficulty. Human consciousness as we know it, did not always exist; and when it arose there was a genuine creative, or spontaneous evolution, no matter to what extent elements of continuity can be pointed out between the higher and the lower, the recent and the ancient mental life.

Of course, all the foregoing arguments, as well as the arguments in the preceding chapters, are based upon facts as we now know them, not upon facts which are as yet unrevealed to man. The objector has the right therefore to question them and to reply, "Further knowledge of facts may ultimately eliminate discontinuity." That is, he has the right to do so if he is merely pointing out that science in general is a tentative search for information; but he has not the right, without far more in the way of fact to bring to his support than he now begins to have, to urge us to adopt the metaphysics of complete evolutionary continuity.

Continuity, however, we certainly find, even though not complete continuity. To give a summary account of this side of reality is but to tell of one scientific triumph after another. The discoveries of recent years have brought us hope that we shall be able some day to explain fully the periodic law in chemistry, and every year is bringing new information of chemical and physical con-

tinuity in the phenomena of life. Thus chemistry and biology, the most empirical of the sciences, promise to become in part deductive. Indeed in every field of science we are taught not only that facts seem more and more intimately connected but also that they are revealing *why* they are interconnected.

3. *The logical strata of reality.*—The result is that the world appears to have a distinct metaphysical structure made up of strata, or levels each of which is logically continuous. The basic stratum is the logical and the mathematical, for nowhere in reality do we get beyond the realm of logical and of mathematical law. It would not even be an exaggeration to say, changing the figure of speech, that reality has a skeleton made up of the terms and relations studied in logic and mathematical science. On this account it is the ideal of science to reduce every problem that can be so reduced to a mathematical problem.

Above the mathematical and almost as extensive as the mathematical is the level of the physical. It may even be that every non-physical part of the existent world has its physical substructure. Otherwise and more rigorously expressed, it may be that every non-physical aspect of existent things is in one to one correspondence with a physical aspect. For example, we are taught that the different colors correspond to different undulations of the ether, that each sound has its correlate in terms of air vibrations. Further, it is believed that all the aspects of things which we call their chemical properties have likewise physical correlates, namely electrons and their properties. So too, it is widely believed that all

physiological phenomena have chemical-physical correlates and finally that all mental phenomena have in their turn physiological and so ultimately physical correlates, though some scientists vigorously dispute this.

Above the physical stratum lies the chemical and above the chemical the vital and above the vital the mental. Regarding each of these strata the same question arises, that is, *how far is there a one to one correspondence between the terms of the higher stratum and the terms of the stratum immediately below?* This is one of the most important problems in all metaphysics. In general, the working hypothesis of science is and has been that there is this one to one correspondence between the discontinuous and the continuous; but whether or not the hypothesis is true, the facts alone can decide. So far the facts have greatly favored the hypothesis. But it is an open question whether or not they do so always.

Further, each of these logical strata can itself be analyzed into substrata; and so the problem of the logical levels of reality is a very complicated one, requiring for its careful study at least a thorough elementary knowledge of the sciences to whose field the strata belong. But for our present purpose the general picture of the successive logical levels is sufficient.

To sum up: the picture of reality just outlined is logically built up of strata. The logical and mathematical are fundamental and universal. The physical comes next and though less extensive is still practically, if not quite, universal. Then comes the chemical, very extensive but by no means universal. Next comes the biological, extensive but vastly less extensive than the

chemical. Finally, comes the mental and especially the human and the social, far less extensive. Thus to understand man we have to know mathematics, physics, chemistry, biology, psychology, for all these levels are in his constitution; whereas to understand the sun, whose heat and light make human life possible, we can quite ignore biology, psychology, and all that is peculiarly human and social.

Similarly, if we study the history of the solar system we behold these same logical strata in an historical order. In the very hottest stars it may be true that many of the chemical elements known on earth have not yet arisen; and so it may be that if the sun was ever a far hotter star it lacked chemical elements it now possesses. At any rate it lacks most of the chemical molecules we know on the earth. These molecules must have arisen in the course of the earth's history as it passed from a molten condition to its present condition. As we go back in our research to the earliest geological ages, all traces of life disappear and the earth seems to have been constituted solely of the chemical and physical. Gradually more and more complicated forms of life appeared until man appeared and finally after man there have appeared his social and civilized life and its achievements.

4. The logical dependence of the sciences upon one another.—We have seen that the various sciences are working out distinct logical levels, or strata of reality. These strata are logically prior to one another and this accounts for the evident logical independence of some parts of science upon other parts. In general, logic

and mathematics, including mechanics, are logically prior to all other sciences. Mechanics is independent of chemistry, but chemistry presupposes mechanics. Between physics and chemistry there is no doubt a more complicated relation; but parts of physics are logically prior to parts of chemistry. Chemistry and physics are logically prior to biology, and biology to psychology. A more suggestive way of expressing this is to say, a physicist must be a mathematician, though a man can be an eminent mathematician and be ignorant of physics and chemistry. The physiologist must be a student of inorganic chemistry, but the inorganic chemist may be ignorant of physiology. So finally the general psychologist must be a student of biology, but many a student of biology may succeed in his science without knowledge of psychology.

5. *The passage from simplicity to complexity in evolution.*—Our results in this and preceding chapters give us the information needed to correct the popular error that in evolution the total existent entity passes absolutely from a condition of simplicity to that of complexity. Such a statement is true only relatively. In certain respects the adult man is more complex than the child, the ox is more complex than an amœba, and the earth than the sun. But the general principle of discontinuity forbids us to infer without further evidence that such is absolutely the case. A drop of water appears to us far less complex than an amœba solely because we are thinking in terms of chemistry. *Chemically* it is far less complex; but could we know all its as yet unknown discontinuous properties, we might find both objects infinitely

complex. Not that we know that we should so find them, but that such a nature is suggested by the entities which we can study in detail. For example, a man as seen some miles away is a mere homogeneous, black speck; and could we never see him near by, we might think him a quite simple or atomic entity. Again, an ovum, relatively simple to our highest power microscopes, we know to be a most complicated chemical and physical machine. Hence what might even an electron prove to be, could we examine it as readily as we do an ovum, a human body, or the earth!

Another popular error too should be corrected. We often think of the universe itself evolving and passing from a simpler to a more complex constitution; but this again does not follow; for it may be that such a thought is comparing infinite complexity with infinite complexity. The only justifiable point that can be made is that the older the universe becomes, the richer in history it becomes also. But this does not mean that the universe grew from simple chaos as the ancients believed, or that it ever will pass into such a chaos. We shall have rather to confess our ignorance of such things, claiming only that simplicity in one respect does not necessarily mean simplicity in other respects, that simplicity in the logically continuous does not mean necessarily absolute simplicity.

Finally, we shall have to confess our ignorance as to what objects best represent the general character of the universe. On the one hand is a tendency to regard the mechanically simplest as the best representative and so to picture the world as a vast machine. On the

other hand is a tendency to find in man and the society of men, which seem to us the most complex types of existence, the most enlightening analogy with the universe. But we have no ground for either analogy. The evidence is lacking which would enable us to point to this or that thing and to say this thing is the goal of existence or that thing is absolutely more complex than this thing, or again to say this thing is more thoroughly representative of reality, or that thing is negligible in our account of reality. On the contrary each thing is, as far as we know, representative of reality, each thing is a goal of existence, and each thing may be in its total nature as complex as anything else.

All this, however, must not be misunderstood. It does not mean that there are not genuine values in reality or that we should not value one thing more highly than another. Nor again does it mean that things which science finds simpler or more complex are not truly so in those respects which are under study by the scientist. It means rather that a world which has its logical strata and within these logical strata its logical continuity, has also probably everywhere its logical discontinuity and possibly everywhere its infinite complexity.

6. *Conclusion.*—The picture of reality which we now have before us may be described thus: Looked at from the standpoint of logical analysis, reality reveals many distinct logical strata which give its parts considerable logical continuity and which make several of the sciences logically prior to one another and so make them form the familiar logical hierarchy. At the same time, logical

discontinuity between these strata is most conspicuous. Though science is constantly discovering further or hidden continuity and thereby suggests that no discontinuity is ultimate, yet the facts as we perceive them seem to discourage forever the hope that discontinuity can be eliminated.

From this same point of view reality is not only discontinuous at any one time, but it is discontinuous also in its history. The new, or logically discontinuous, is constantly arising; and it would seem that genuine creative evolution is the story of each thing that exists, giving a picture similar to that given by the growing and living organisms.

Looked at from the point of view of the simplicity and complexity of structure, that is, from the point of view of the number of constituting terms and relations, reality suggests indefinite complexity. Of course, further facts alone can enable us to ascertain whether or not all known entities are complex; yet the facts already observed are revealing to us more and more complexity, and are consequently suggesting indefinite complexity.

Looked at from the several standpoints we have taken in preceding chapters, reality is a system of universal laws and particular entities. The universal laws give it its causal system; but the existential particular entity always portrays properties which cannot be fully deduced from causal law. This makes the interaction between particular entity and particular entity logically discontinuous in its results. In short, causation and evolution actually *produce;* they bring into being the new. Returning to the language of logic we may then conclude: *In*

part the existent is logically continuous and lends itself to deduction from universals; in part, perhaps vastly the greater part, the existent cannot be discovered except by actual perception: and therefore in part the existent can be explained by universals and in part it can be explained only in terms of the actual particulars revealed to perception. Thus each existential entity seems both a creature of causal law and a centre of spontaneous, or creative evolution.[1]

[1] The student's attention should be called to an important hypothesis which seems to contradict the results we have here reached and to imply a logical continuity throughout existence. This hypothesis can be best studied in the essay by Holt, in "The New Realism," New York, 1912, and in the appendices by Holt and Montague. I do not believe myself that Holt's hypothesis implies a world of complete logical continuity.

CHAPTER XIV

SUPERNATURALISM

1. *Introduction.*—The four remaining chapters of this part will be given to a brief study of four metaphysical hypotheses which during centuries past have played most important rôles in European thought. These hypotheses are supernaturalism, the substance hypothesis, idealism, and criticism. Supernaturalism teaches that beyond the world there is a creator and sustainer of the world, God. The substance hypothesis maintains that the world is constituted ultimately of substances and that all existents are either substances or the predicates of substances. Idealism asserts that all facts are mental and that the universe is solely the experience of one or many minds. Criticism maintains that the nature of knowledge is fundamental to the nature of reality. Let us turn immediately to the study of the first.

2. *Supernaturalism.*—Supernaturalism maintains that the facts can be explained only in part by the world of which they are members and that the ultimate explanation of all existence lies logically outside the world system. The world has a first cause, or creator, God; and this cause is not itself part of the world. God transcends the world. He is beyond the world, but not beyond in a spatial sense (although the latter was the ancient belief); because space itself belongs to the world system. He is

beyond the world, but not in a temporal sense (although the latter again has been and is held by most people); for time likewise belongs to the world system. In other words, God does not create and rule the world from some far away point in space, nor did He create the world at some date in time. Rather we have to say, He created both space and time themselves; and He transcends them both.

Did He live in space or did He act in time, we should have to infer that He is part of the world and possibly a finite part. If He is a finite part of the world, then it would be no longer true that the full explanation of the existent world carries us logically beyond the world. The problem of His existence and of His nature is no longer metaphysical or logically fundamental, but the same as many another special problem in the sciences. It would be of the same order as ascertaining whether this or that sidereal body exists or not, or as ascertaining the origin and nature of the comets or the origin and nature of life. In short, supernaturalism asserts a complement to science, a second system of knowledge, a theology, which, it believes, reveals to us the fundamental explanation of all existence.

Opposed to supernaturalism stands a contradictory doctrine, naturalism, which teaches that the world is ultimate and that the facts are fully explicable in terms of the world. If there be a God, He is the universe, or the substance of things, or thirdly some superhuman finite being; and therefore not the creator of, but a part of the world.

In the history of European thought the two rival tend-

encies, supernaturalism and naturalism, have competed with one another from the days of the Sixth Century B. C. in Greece to our own time; and it is this intellectual strife that has been improperly called the warfare between religion and science. In general, the Greco-Roman and the medieval thinkers tended to be supernaturalists, and modern scientists, beginning with the Renascence and Reformation (Fifteenth and Sixteenth Centuries), have tended to be naturalists.

FOR FURTHER STUDY READ:

Moore, The Christian Doctrine of God, in *Lux Mundi*, edited by Charles Gore;

Lodge, The Christian Idea of God, *Hibbert Journal*, 1910-11, *9;*

Consult for further literature, art. "Theism," *Encyclopedia Brittanica*, 11th ed.

3. Origin of supernaturalism.—Originally men were both naturalists and supernaturalists, or more precisely neither, for the issue had not been raised. Primitive tribes and the ancient civilized peoples explain the facts of nature after the analogy of human conduct. If any object or event is of man's authorship we usually enquire, Who did it? What purpose had he in doing it? How was he able to do it? And when these questions have been answered we rest satisfied, because for our ordinary needs no further explanation is required. The naive man of all ages and lands not only finds such an explanation of human conduct final but also feels without further questioning that everything else is to be explained in this same way. Familiar with his own deeds, his motives and his powers and with the deeds, motives and powers of his fellow tribesman, and grossly ignorant of all that we to-

day call science, how natural for him to put to everything that he observes attentively or that arouses his emotions the same questions he would ask regarding his own deeds. At one time braving a storm, at another basking in the sunlight; at one time threatened with drought and famine, at another bountifully supplied with food and drink; at one time facing the dangers of sickness, of wild beasts, or of war, at another time being free from these calamities, he asks: Who are bringing these things to pass? What are their motives? What can we do to keep their friendship, win their good will, or avoid their hostility? How great and awful must appear to him the powers of some of these agents! Thus in time nature seems peopled with gods and demigods who constitute a realm far superior to that of man and whose life and environment, compared with his, are more blessed and more wonderful. As man's experience and insight increase, the gods seem more and more unlike him, far wiser and more powerful, far more righteous and more inscrutable. Finally, as the world seems to man less and less chaotic and more unified, so too do the gods seem to him either to form a hierarchy with a supreme god at its head, or to merge into one universal god. Moreover, while man is growing toward monotheism, he is gaining some insight into the natural causes of things; and as a result, nature itself becomes a realm more and more distinct from the supernatural, until the two realms stand over against one another, sharply contrasted. It is with this final stage only, that we are concerned, where one God alone is believed to exist or is at least thought to be supreme, and to be the ultimate author of all existence and of all moral law and

religious custom, and where the world of man and of nature are kept distinct from God their creator. At this stage supernaturalism tends to become a metaphysics, a theology.

4. The issue between naturalism and supernaturalism.— In an issue of long standing it is probable that right is on both sides and that both parties can be reconciled. If science is naturalistic, it is so for valid reasons; and if religion is supernaturalistic, it too is so for valid reasons. The business of science is to explain certain types of fact, which means, to find their logical ground. I say "certain types of fact," for some facts such as values we have excluded. Moreover, if God can be perceived, as the mystic claims, then God also is a fact. But if God be fact, He is not studied by science in the narrow sense. The facts of science are those which are popularly called "natural facts;" and of these science seeks, as was said, the logical ground. The question, then, becomes solely, why do these logical grounds form a naturalism and thereby exclude supernaturalism from science? The answer is apparent from the results of earlier chapters. The logical grounds of these facts do not lead us to some one cause but to an indefinite number of causes. The only possible means by which they could lead to one cause would be by there being some one proposition from which all other existential propositions can be deduced; but there is no such proposition. In general, the result of scientific research is not to give us a system beyond the world, but to give us the world. The only result of science which resembles the supernatural is the hierarchy of universal existential propositions leading logically from

the particular to the most general. But, as far as we know, these most general propositions are many in number, and they are such propositions as those of mathematics, as the law of gravitation, and other highest generalizations of science. They are neither one in number nor are they supernatural.

Further, these causes or grounds of fact whether particular or universal are logically ultimate. They are *first* causes. To demonstrate, one has to have premises, and, from the nature of the case, first or primitive premises. Logic can never free us from this necessity. But supernaturalism at times seems to ask, Why are these premises true? What lies logically behind them? And of course science can only reply, "Nothing, for they, or some unknown similar propositions, are logically primitive." Therefore, God is not the *logical ground* of so called natural facts, which is another way of saying, the existential propositions constituting the world are a complete logical system by themselves and are not deducible from the propositions of theology. But that science is and should be naturalistic does not imply that supernaturalism is false. If they contradict one another then indeed one or the other is false; but it is not at once evident that they do contradict; for we know that much is true which is not science in the narrow sense, for example, morals and art.

Let us then consider briefly where supernaturalism may have its logical beginning independent of science. (a) In the first place the mystic has to be considered. The mystic claims that he perceives God and the supernatural, and therefore claims that God and the super-

natural are facts. Now there is no way of proving the mystic wrong except by getting facts which are inconsistent with his claims. As long as there is no such inconsistency apparent, science should not say one word in protest; for such a protest would be as blind as is the belief of him who finds only marble in a Greek statue, or only air vibrations in a symphony or only nonsense in the vision of the poet. If the mystic, or the religiously minded, does indeed perceive God and the supernatural, then there is another realm besides the world, a realm of a different logical order, and the naturalist will have to make room for supernaturalism. It is true, he will not have to do so by ceasing to be a naturalist; but he will have to formulate his naturalism in such a way that it does not contradict supernaturalism, precisely as he has to in order not to contradict morality and art.

(b) In the second place, the ultimate logical basis of our explanation of the world, even though logically ultimate, is not logically necessary. Expressed more simply, the existent world is not the only logically possible world. As far as logic teaches us regarding existence there are, or conceivably there may be, an infinite number of worlds which would conform to the principles of logic as truly as does the actual world. We can go farther: the actual world is not the only mathematically possible world. There might be a world of four, five, or n spatial dimensions. There might be a world of two or more time dimensions instead of the one dimension which real time seems to have. Finally we have seen that the world contains or appears to contain everywhere a large element that is chance, that simply has to be taken as logically ultimate

and therefore inexplicable. In short, the actual world cannot be deduced from logic, mathematics, mechanics or any number of general sciences. Technically expressed it is a contingent, not a necessary world. There is no scientifically assignable reason why it should not have been a very different world. The most the naturalist can say regarding such matters is, "This is the world as I find it. Where the world is inexplicable there for me it is logically ultimate, for logic can take me no farther. Thus my office is to explain the part of the world which is not logically ultimate in terms of the parts which are logically ultimate."

Can the supernaturalist do more? Strictly speaking, No. He too has to take the world as he finds it. He too cannot deduce the logically fundamental from something that is logically more fundamental, for the fundamental is ultimate and has no degrees of comparison. Yet is it not a significant truth that the world is contingent, that it is only one of many possible worlds? Of course this question cannot be answered rigorously by the supernaturalist until he defines or knows precisely what he means by the words, "having significance." However, all the naturalist has a right to say is that these words must not mean a logical deduction of the world from theology. The philosophers of past ages made the attempt again and again and failed and had to fail. Meanwhile the religious mind asks and persists in asking "why the world which exists?" It persists that its question is a genuine one and that religious insight can discover the answer or that to religious insight the answer can be revealed. It claims to perceive fact, and I see no

just protest which naturalism can make to this claim provided no facts are found which contradict the claim.

Finally, the supernaturalist has not been the only one to make mistakes. If the supernaturalist has held opinions contradictory to verified science, an equally serious fault can be charged against many a naturalist, for he has often been blind to genuine facts. That this world is a world in which men perceive moral truths and artistic truths, in which they do struggle for the ideal and in which to some extent they are able to realize that ideal is indubitable truth. How much more is true can be learned only by further insight, not by deductions from our present blindness. To say all this is not to open the gates wide to every form of obscurantism. Rather it is to maintain that the world as conceived by science is and should be a naturalistic world, even though it admits that the actual world may be also supernaturalistic. It provides for both separately and conjointly the same ultimate tests of validity, logical consistency and perceived truth. Duty compels the metaphysician to admit all this, for metaphysics to-day is naturalistic and should be so; and especially does duty bid the metaphysician to admit this, before he proceeds to show the failure of certain older metaphysical doctrines derived from theology and urged in the defense of the supernatural.

To put my point positively and definitely, the metaphysician finds that the actual *status quo* of science to-day is naturalistic. But at the same time he has to admit in fairness that it belongs to man's religious insight and to the philosopher of religion to answer the two further questions: First, does man's religion postulate a supernatural

world; is religion essentially supernaturalistic? Second, if religion is supernaturalistic, how can this belief in a supernatural world be so formulated that it does not contradict the naturalism of science? These two questions constitute the fundamental and the most pressing philosophical problems which to-day face the theologian and the philosopher of religion. If these thinkers face them fairly, no doubt they will find a solution; but to attempt to solve these problems by first demanding of science to surrender her naturalism is to ask history to move backward. Moreover, both the theologian and the philosopher of religion should not forget that naturalism itself has its religion and moral idealism; and that many naturalists claim that supernaturalism is not essential either to the validity of the ideal or to man's enthusiasm for the ideal. To repeat, the supernaturalistic thinker faces a twofold task: first, to show the necessity of supernaturalism, and second, to reconcile it with the naturalism of modern science.

FOR FURTHER STUDY READ:

Santayana, Life of Reason, III, Reason in Religion;
Otto, R., Naturalism and Religion, 1907;
Ward, J., The Realm of Ends, or Pluralism and Theism;
Wenley, R. M., Modern Thought and the Crisis in Belief;
Balfour, A. J., The Foundations of Belief.

FOR MORE EXTENSIVE STUDY READ:

White, A. D., A History of the Warfare of Science with Theology in Christendom;
Boutroux, E., Science and Religion in Contemporary Philosophy;
James, Wm., Varieties of Religious Experience.

APPENDIX TO CHAPTER XIV

THEOLOGY AS A METAPHYSICS

1. *Introduction.*—An appendix is devoted to this subject because of the very great rôle theological problems have played in the history of metaphysical theory; but I shall endeavor to deal with these problems with utmost brevity, for I believe they can be studied to much greater advantage in a book on the history of philosophy than in a textbook on metaphysics.

Within theology three major metaphysical problems have emerged: first, the proof of God's existence; secondly, the nature of creation; thirdly, the relation between God and the world. The historic proofs of the existence of God as world creator are also three: first, the ontological argument; secondly, the cosmological argument; and thirdly, the teleological argument.

2. *The ontological argument for God's existence.*—Briefly stated the ontological argument runs, "from the definition of God we may infer His existence;" and the counter-argument retorts, "no definition proves the existence of the term defined, for facts alone can verify an existential hypothesis." To take up the various forms of the ontological argument and their presuppositions would compel us to discuss again many matters which have been studied under other headings. There is, however, this common form and presupposition to all the arguments. The authors endeavor to give us an hypoth-

esis which will not need for its proof the crucial tests which all other existential scientific theories require, that is, the observation of facts which these theories uniquely explain. The method of avoiding this test in the ontological argument is so to define God that His existence is given by definition. For example: God is "the most real" of all things and must therefore exist; or God is "the most perfect" of all beings, and did He not exist some other entity which possesses the attribute of existence lacking in Him, would be more perfect, but this contradicts the definition.

Thus the definition of God becomes more than a mere definition, for it includes not only a definition but an hypothesis. Even though the hypothesis were true, to make it part of the definition would be to beg the question at issue. But the hypothesis is not true. The hypothesis is this, "some information regarding existence can be known to be true without appealing to fact as proof." Notice also that if God's existence is a perceived truth, this objection remains valid. To know by perception that God exists is not to know so by analyzing logically the term God.

It may, however, be maintained that the foregoing misinterprets the ontological argument. It may be said "the ontological argument first defines God and then calls upon us to perceive that God as thus defined exists." Probably this has been the intent of many who have supported the argument. If so, the question becomes, is the definition of God correct as a definition, and is the existence of God, as defined, self-evident?

It is difficult to answer these questions briefly. In

general the tendency has been to define God as the logically fundamental, but this is to make Him synonymous with logic, mathematics, and other fundamental truths of science. Or the definition has made Him the highest or most universal entity. This again identifies Him with logical principles. Or finally the definition has made Him the substance of the world; but this leads to a pure naturalism if there is such a thing as the substance of the world, and to a denial of His existence if there is not such a thing.

FOR FURTHER STUDY READ:
Anselm, Proslogium, esp. Chap. III;
Descartes, Discourse on Method, or
Descartes, Meditations;
Kant (Watson's Selections from), 195–210;
Lotze, Microcosmus, Bk. IX, Chaps. IV and V;
Russell, Philosophy of Leibniz, Chap. XV.

3. The cosmological argument for God's existence.— This brings us to the cosmological argument, which may be stated briefly as follows: The facts we observe daily are not self-explicable but require for their explanation that fuller account of things which the sciences are endeavoring to discover and to formulate. But the world of science in turn requires an explanation, because it is not a logically necessary world but a contingent world. There must be then not only a complete but also an absolute and necessary explanation of the world. By a complete explanation is meant one that will account for the existent in each and every aspect; and by an absolute and necessary explanation is to be understood one that does not itself require an explanation. Ex-

pressed in terms of cause and effect, there must be a complete and absolute cause of all existence, a complete cause to account for each phase and aspect of existence, and an absolute cause or *causa sui* which is not in turn the effect of some further cause. To this should be added, we are not to think of this ultimate cause as that which once upon a time, ages ago, brought the world into existence, a first cause in the sense of the beginning of an historical series. Rather we are to think of it, as we think of the law of gravitation, the eternal, or ever present factor by means of which we explain part of the behavior of the solar system and of all other sidereal systems. The ultimate cause is always acting, always creating. Now this ultimate cause is, by definition, God.

The subject matter of this argument we have already studied. The ultimate logical explanation of existence is the array of logically primitive propositions from which existence follows logically. We have seen that as far as we know this array of propositions may be even infinite in number. It is true that the world is not a logically necessary world, is, in other words, a contingent world; but this means only that the world cannot be deduced from the principles of logic and of science. Even if it could be so deduced, that would not prove God's existence. In short, the error of the cosmological argument is twofold: it confuses God with the logical ground of the world, which we have seen He is not; secondly, it believes that the nature of this logical ground can be easily discovered either from logic or from a few general axioms. Thus the God of the cosmological argument is not a transcendent cause, a supernatural being. He

is the logically universal and logically primitive aspect of existence; and therefore He is thoroughly naturalistic. Indeed the history of philosophy witnesses over and over again to this by the constant tendency to drift into naturalism on the part of those who supported the cosmological argument most rigorously. The most famous example of this tendency is the pantheistic and naturalistic philosopher Spinoza.

FOR FURTHER STUDY READ:

Anselm, Monologium, esp. Chaps. I–XXXVIII;
Descartes, *loc. cit.;*
Locke, Essay Concerning Human Understanding, Bk. IV, Chap. X;
Russell, Philosophy of Leibniz, *loc. cit.;*
Kant (Watson), 210–218;
Lotze, *loc. cit.;*
Hume, Enquiry Concerning Human Understanding, Sect. XI.

4. The teleological argument for God's existence.— The most familiar form of the teleological argument is the argument from evidences of design or purpose in nature. Consider the earth: how wonderfully adapted it is to be the home of life, of plant, of beast and of man, and finally of society and civilization! Consider the wonderful adaptions found in all forms of life to feed and protect the individual and to bring about the procreation and preservation of the species! Surely we must infer from all such wonderful adaptions of means to ends the workmanship of an infinite intelligence planning what He performs.

The errors in this argument are many. (a) First there is the question of fact. Does nature reveal the plans of

a workman? Life is created but it is also ruthlessly destroyed. Some processes of nature favor life and higher adaptations; other processes hamper the progress of life seriously and even fatally. (b) Secondly, even if it were true that nature reveals the plans of a workman, this would not prove that a transcendent or supernatural God exists but that there is some superhuman natural agent at work in this world, a mind whose intellect far surpasses man's and whose means of carrying out his purposes are vastly greater than man's. In short, it would prove that there dwells in nature one or more finite gods, related to us somewhat as we are related to the lowest forms of life. (c) Thirdly, a correct teleology does not find in the facts appealed to in the teleological argument the plans of a workman, for the teleological aspect of nature is not analogous to human plans and work. Man's plans are outside of the things he manufactures, are forced upon them by his will from without. Nature's plans are immanent. The acorn does not grow into the oak as lumber grows into a house, or clay into a statue. Life has come into existence on this earth and has progressed as it has by way of evolution, not by way of manufacture. All this indicates that if the teleological argument is to be accepted, it must be completely transformed. The upholder of this argument may indeed be right in finding in evolution a wonderful and most significant aspect of reality, but he is wrong in making it comparable to human workmanship.

FOR FURTHER STUDY READ:

Paulsen, Introduction to Philosophy, 145–180;
Spinoza, Ethics, Pt. I, Appendix;

Kant (Watson's Selections from), 218–222;
Lotze, *loc. cit.;*
Marvin, Introduction to Systematic Philosophy, 320–328.

5. *The nature of creation.*—By the problem of the nature of creation we mean the theological and scholastic problem, whether God's intellect or His will is fundamental. The metaphysical importance of this question is the radical difference between the world conceptions which have arisen from the different answers. If the world and the moral law follow from God's intellect, then the world is conceived purely as a logical system following from certain general axioms; for these axioms, known to God, determine His creation. On the other hand if God's will is supreme, if the world which exists does so simply because God has chosen it, its origin is inscrutable. That is, the world is now conceived as one out of many logically possible worlds, one chosen from them by a method defying logical explanation. It is conceived as a world where an inexplicable agent rules as well as logic, indeed where this agent has even decided that logic should rule. In this its extreme form, the doctrine that God's will, not his intellect, is the true origin of the world and of the moral law is a type of romanticism. In a more moderate form it is another way of saying that chance as well as causation are required to explain the existent.

FOR FURTHER STUDY READ:
Lotze, *loc. cit.;*
Consult Histories of Philosophy on Thomas Aquinas and Duns Scotus;
Windelband, History of Philosophy, 328–337.

6. The relation between God and the world.—A number of technical terms are used to express the different views held regarding the relation between God and the world. Of course these different views often imply also different conceptions of God.

Theism is the doctrine that God is supernatural and usually also that God is personal. His relation to the world is conceived as ultimate, such that all things and events are to a greater or less extent to be explained directly as issuing from God. This is the familiar doctrine of God's providence.

Deism has much the same conception of God, but denies any intimate relation between God and the particular existent. God created the world; and whether or not this creation is conceived as purely timeless or as in the far distant past, the world, apart from the original act of creation, is independent of God. As a clockmaker might manufacture and wind a clock and as afterward it would go for days or weeks without further attention from him, so God, the perfect clockmaker, created the world and then left it quite capable of running itself. The only sense in which there can then be a divine providence is that all parts and stages of the world were foreseen and predestined by God.

Pantheism denies a supernatural God. God is either the world, or is the substance of the world. Nowadays this doctrine is often expressed in the proposition, God is immanent in the world. The pantheist may or may not hold that God is personal. In any case pantheism is a form of naturalism.

The finite God. Besides the foregoing doctrines of

the relation between God and the world there is the doctrine already alluded to, that God is a part of the world, that He is of a far higher order of spiritual being than man but otherwise analogous to man. He, as man, is struggling in a world which limits Him and thwarts His will. This doctrine too is a naturalism.

Atheism. To this list should be added the name atheism. This doctrine is a naturalism, denying the existence not only of a transcendent God but also of both a pantheistic and a finite God.

FOR THE STUDY OF THEISM READ:
Flint, R., Theism, N. Y., 1893;
Lotze, *loc. cit.*

FOR THE STUDY OF DEISM CONSULT:
Histories of Philosophy on English Deism.
(Some of the original deistic writings are especially worth reading.)

FOR THE STUDY OF PANTHEISM READ:
Paulsen, Introduction to Philosophy, 207–312;
Spinoza, Ethics, Pt. I;
Flint, R., Anti-theistic Theories.

FOR THE STUDY OF THE THEORY THAT THERE IS A FINITE GOD READ:
James, Pluralistic Universe, Lect. VIII.

CHAPTER XV

THE SUBSTANCE HYPOTHESIS

1. *Introduction.*—To the primitive thinker the world is literally what it looks to be. It looks to be made up of *things*, trees, rivers, oceans, rocks, mountains, animals, clouds, fire, souls and not only many other similar objects but also objects which the modern adult European would hardly call things, such as the sky, the wind, fog, and darkness. These things have certain striking differences. Some of them are more or less permanent though others are noticeably transitory. At one extreme are rocks and mountains, at the other are cloud and fire. Again, many objects though different from one another in some respects are evidently similar in other respects, and are often believed to be but variations of the same fundamental thing. Then too, some things are directly manufactured out of other things, spears and boats from trees, pots from clay, bronze from metallic ores, and bread from grain.

As a matter of course, at the birth of science these facts would be among the chief ones to be considered, and far less noticeable facts would be either partly or totally ignored. Consequently the following assumptions and naïve theories constitute part of the first stage in the history of science. Many things which appear to be different are really one and the same thing in different

forms. Not only are the pot and the clay, or the seed and the plant the same thing, but so also are water and ice, earth and rock, water and mist. But if this explains the noticeably common characteristics, may not also the less obvious likenesses between things be explained after the same manner? If ice and water are the same thing, may not water and rock be so too? Water dries up and leaves a sediment; water (in the case of springs) comes seemingly directly out of the rock; therefore are not water, earth and rock all the same thing in different forms? Again, wind and fire are somewhat alike and related? May they not also be the same thing? For similar reasons are not cloud and rain, water and mist, sky and fire, cloud and lightning, and thus water and lightning (or fire) the same things in different forms?

In short, are not all things composed of a few fundamental types of stuff, or possibly of the same ultimate thing or stuff? Indeed is there not evidence that all things give rise to all other things changing directly or indirectly into one another, the cloud into fire (lightning) and into rain, the rain into earth and rock, the rock into water, the water into fog and mist, the mist into cloud, the cloud into sky, the sky into light? If so, which of these things is the fundamental thing or true stuff? The favorite answers at first were, earth, air, fire and water, or all four of these. In time, however, further information and reflection raised the final question: Are not even earth, air, fire, water, or any other sensible thing, but forms of some less easily observable, or even imperceptible, stuff? That is, are not all the things which we observe but the qualities or states of a true thing, or

stuff, behind or beneath them; are they not but forms of matter?

Further, the true stuff must be one which in taking on new qualities and in parting with old qualities never loses its original characteristics. Hence it came to be believed that there are two types of qualities: first, those which are coming and going, such as color and warmth; secondly, those, whatever they may be found to be, which are eternal and changeless. These latter are the ultimate attributes or properties of the stuff, whereas the other qualities are accidental. Thus color, heat, weight, fluidity, and other such qualities, were thought to be mere accidents of matter; whereas impenetrability, movability, spatial extension, were regarded as attributes.

To express these distinctions, technical words came to be employed. The fundamental stuff is the *substance* (that which stands under); the permanent characteristics are the *essence*, the properties, the attributes or the primary qualities; and the changing qualities, the *accidents*, the modes, or the secondary qualities. Another set of important technical words came from formal logic. As we speak ordinarily of the thing and its qualities, logic speaks of the subject and its predicates. Hence the substance, or true thing, was called the *true subject*, the subject that is itself never the predicate of some other subject; and the two sorts of qualities were called the two sorts of predicates, the *essential* and the *accidental*.

If then the true thing is not any one of the perceptible things in the world about us, it has to be found by ab-

stracting in thought from each thing the accidental or changing qualities. In short, substance is not a percept but a concept. Hence substance cannot be seen by our bodily eyes, but by our intellectual insight, by our reason. The world as revealed to our senses is more or less deceptive, for it seems to contain many things which are not truly things; and these things have qualities that are merely accidental and that hide the eternal or essential qualities. Here again technical words came to be used: The world as revealed to sense, the world of accidents and pseudo-things, is the perceivable or *phenomenal* world and these things and their qualities are *phenomena*; whereas the true things, the substance revealed by the reason, are *noumena* and the world of substance is the rational, the *intelligible* or the *noumenal* world.

FOR FURTHER STUDY READ:
Burnet, Early Greek Philosophy, 2d ed.

2. A more rigorous formulation of the substance hypothesis.—The substance hypothesis can be stated with greater logical rigor and indeed must be so stated to be thoroughly understood. This hypothesis reduces to a theory regarding the nature of the proposition. In general, there are two theories regarding the nature of propositions. One theory is that which Chapter III has formulated and defended: Propositions consist of terms in relation. The other theory is that which asserts: Propositions are made up of two terms and no relation, one of these terms being the subject and the other the predicate. For example, the upholder of the second theory would say, the proposition, "the flag is red," is

not a relationship between flag and red but the predicate redness asserted of the subject flag. In fact, precisely such examples as this must have given rise to the theory; for it may be that logic will finally decide that this type of proposition is truly a subject-predicate proposition. But the theory has evidently neglected other and familiar types of proposition such as, A is richer than B; A is cause of B; A is to the right of B; A equals B. It seems preposterous to call "richer than B," "cause of B," "to the right of B," and "equal to B," predicates of the subjects symbolized by A; for B is not a predicate of A but another thing; and the information is clearly a relationship between two distinct entities.

Now it seems remarkable, but is none the less true, that the valid conception of the world itself depends upon how this question regarding the nature of propositions should be answered. What does the world, as we know it, reveal to us? What is the information, that is, the content of the propositions we learn as we study nature? Is it made up of subjects and their predicates, or is it made up of relations between terms? If the former, the world does indeed consist only of things and their predicates, that is, of substances and their essential and accidental qualities. If the latter, the world does not consist of things alone. Rather it consists of all sorts and kinds of entities which can stand in relation, not merely things and qualities, but also sizes and shapes, configurations and numbers, quantities and intensities, and most anything else you can mention. It consists of all these entities in their multitudinous relations.

FOR FURTHER STUDY OF THE SUBSTANCE HYPOTHESIS READ:
Rickaby, General Metaphysics, Bk. I, Chaps. II–III, and Bk. II, Chaps. I–II;
Lotze, Metaphysics, Bk. I, Chaps. I–IV.

FOR ADVANCED STUDY READ:
Aristotle, Metaphysics.

3. *Criticism of the substance hypothesis,* (a) *As a question of fact.*—Whether or not the world is made up of substances and predicates or of terms and their relations, is, before all else, a question of fact. This question has presented itself in a number of forms. (1) If we analyze the things we perceive about us, for example, a table, abstracting from them their qualities, or predicates, do we get a remainder, the thing itself or the substance? *Evidently not; a table robbed of its properties, its color, its hardness, its weight, its chemical properties as wood, becomes nothing at all.* The thing is the sum of its qualities and properties in their proper relations, it is not some subject over and above or beneath these predicates, at least not as far as direct sense perception shows. (2) *Some objects cannot be analyzed into substances and their attributes even with the utmost ingenuity. These are space and time and the spatial and temporal relations between entities.* If we look upon space as one thing, as a great container, surely the things within it, the earth, the stones, the animals, are not attributes of space. On the other hand, if we hold that space is made up of points, evidently the relations of these points to one another is quite essential to there being the total entity space. But what are these relations of the points of space to one another; does each point have as its attributes every other point with

their countless relations to one another and to it? In short, whatever space and time are, they do not, as far as our knowledge goes, fit in well with the substance hypothesis. Indeed, this truth appears often to have been evident to those who hold the substance hypothesis; for many of these philosophers have found it essential to their theory *to prove that space and time are not real.* Such a tendency, resulting merely from efforts to uphold a theory, is the *reductio ad absurdum* of the theory. (3) In general, the substance hypothesis appears to be but a vestige of primitive thought and science. Things are more evident to us in childhood and in our ignorance than are relations. *As science progresses,* however, *the relations between things and between the properties of things are not only noticed but become actually the chief and even the sole subject matter of the science.* For example, modern mathematics, physics and chemistry are made up almost exclusively of propositions not regarding things or the predicates of things but regarding terms and their relations. Moreover, when these sciences define things, they do so by asserting of the thing not some predicate but certain unique relations to other things.

(b) *As a question of logic.*—So overwhelming has been the evidence of fact against the substance hypothesis and so great has become the difficulty of explaining nature in terms of that hypothesis that those who still uphold it have resorted to the old distinction between phenomena and reality. *Relations only appear to exist, they are not real.* Relations are fundamentally irrational and self contradictory; and it must be all a mistake when we think we observe them in the world about us. This,

again, is but the *reductio ad absurdum* of the theory; for relations between things are as truly revealed to our perception as the things themselves. Moreover, if relations are unreal, then every proposition is false, for each proposition asserts or implies relations; and, of course, the sciences, including even logic and mathematics, are false, for one and all assert relationships.

In general, the holder of the substance hypothesis has endeavored to explain the facts consistently with his theory by adopting the one or the other of its extreme forms, *monism* or *monadism.* Each, however, is a *reductio ad absurdum* of the theory. (1) To get rid of the necessity of accounting for the relations between things and for the changes that take place in one thing, as the relations between it and other things change, the monist denies that things are true things, asserting that they all are but modes or states of one infinite substance. That is, there is one substance and all of nature with its multitudinous objects, instead of being a system of things, is nothing but predicates of the one infinite subject. All things are what they are and change as they do, not because of their own nature and interrelationship, but because they are modes of this infinite substance. To this theory there are two fatal objections.

First, you do not by this method get rid of one single problem that faced you at the beginning. The countless particular problems of daily life and of science remain unanswered; for example, why does ice melt when put near the fire? The only answer that has ever been given to such questions remains a proposition asserting some sort of relationship between terms. Secondly, when we

turn our attention to the infinite substance of which all objects are but modes, we find we have but a high abstraction which throws no light whatsoever upon anything, even upon why the substance itself has predicates, let alone why it has the predicates it does. All attempts to make it illuminating by holding in addition the organic theory of relations and by insisting that this infinite substance is concrete give likewise only promises and never any results. There is not one specific problem of science or of daily life which has been solved completely or in part by this monistic theory of substance.

(2) Secondly, the case is no better when monadism is the extreme adopted. Monadism admits that many substances exist and consistently maintains that the business of a substance is to be the logical ground of all its predicates. If things appear to get their predicates through relations to other things, this is mere appearance, for true substances are independent of one another and therefore cannot interact. Hence the world which appears to be made up of many interacting things is really made up of substances which are each independent worlds. Of course, the monadist has to argue away the existence of space. But he cannot ignore the correspondence revealed in the behavior of the various substances. Mind and body seem to interact. Two colliding billiard balls seem to influence one another. The sun seems to have something to do with the orbit of the earth. The only escape left the monadist is either the preceding monism or occasionalism. The former requires him to give up his theory. The latter reduces it to absurdity, by asserting that the seeming interaction between substances is either

a perpetual miracle performed by God or is a preëstablished harmony foreordained by God when He created the world. In either case the monads are no longer true substances, for they are not the true subjects of their predicates, being acted upon from without by their creator. In short, there is but one consistent monadism, a monadism that is atheistic and that asserts the world of science and of daily life to be completely an illusion.

However, the most serious criticism of the substance hypothesis is that already indicated. *The hypothesis explains nothing.* Whatever properties we ascribe to the substance in order to explain its predicates, have been previously borrowed by us from those very predicates. And if we refuse to borrow in this way we are still worse off, for the substance then is the barren abstraction, "thing in general," from whose nature anything or everything follows with equal cogency or rather without any cogency whatever. For example, to explain by means of the substance hypothesis why fire burns amounts either to saying that fire burns because it is fire, or to saying that fire burns because it is the nature of the substance of fire to burn. In short, the substance hypothesis is like a treadmill where no matter how laboriously we hasten onward we arrive at precisely the same point from which we started.

FOR FURTHER STUDY READ:

Berkeley, Dialogues between Hylas and Philonous, Second Dialogue;

Hume, Treatise, Of the Understanding, Pt. I, Sect. VI, and Pt. III, Sects. III–V;

Russell, Philosophy of Leibniz, especially, 8–15, Chaps. IV, X;

Russell, Principles of Mathematics, Chaps. XXVI and LI;
Bradley, Appearance and Reality;
Stout, Alleged Self-Contradictions in the Concept of Relation, *Proc. Aristotel. Soc.*, 1901–2, *2;*
Royce, World and the Individual, Supplementary Essay.

APPENDIX TO CHAPTER XV

THE METAPHYSICS OF SUBSTANCE

1. *Introduction.*—The substance hypothesis has played so important a part in the history of philosophy and is still so widely held that a study of the various resulting theories must be added to our study of the general hypothesis. Within the substance hypothesis the following major problems arise. (a) What are the kinds of substance? (b) Is substance many or one? (c) If many, are the substances interrelated? (d) Finally, how can we account for the change or the perpetual transformation of the qualities of the substance?

2. *The kinds of substance,* (a) *Dualism.*—We may hold that the mental and the physical are two fundamentally distinct orders of existence and so argue that they are the phenomena of two different kinds of substance, spirit and matter.

(b) *Materialism.*—Against dualism we may argue that the evidence of the dependence of our mental life upon the body and especially upon the nervous system is overwhelming, that this dependence cannot be reconciled with dualism, but only with the hypothesis that our mental as well as our bodily states are the phenomena of matter.

(c) *Spiritualism.*—Thirdly, against both dualism and materialism we may hold that spirit is the one substance and that both the physical and the mental are its phe-

nomena. The grounds for spiritualism are of two distinct types. The grounds of one type are taken from the idealistic hypothesis (to be expounded in the following chapter). The grounds of the second type are suggested by the study of the material phenomena themselves. Matter with its energies and with its wonderful fertility in giving rise to the higher types of physical existence, especially life, seems far more analogous to spirit than to matter as described in our textbooks on mechanics. If matter is the substance of the phenomena of gravity, heat, light, electricity, chemical affinity and life and even of mind, it must have as its properties, or essential nature, enough to account not merely for such mechanical events as the behavior of the balls on a billiard table but also for such non-mechanical events as the vital processes, the reactions, the thoughts, feelings and purposes of the players to whom the billiard balls owe their motion. It is maintained that spirit alone has these properties and therefore that matter must be spiritual.

(d) Finally, against all these three theories it has been urged that neither matter nor spirit is the true substance, but that the material and the spiritual both arise from a common substance, a substance which itself therefore cannot be called either matter or spirit or any other name borrowed from the phenomena. Of the names which have been given to this substance, probably the most usual is the Absolute.

FOR FURTHER STUDY READ:

Smith, Norman, Studies in the Cartesian Philosophy.

FOR THE STUDY OF DUALISM READ:

Calkins, Persistent Problems of Philosophy, Chap. II.

FOR THE STUDY OF MATERIALISM READ:
Paulsen, Introduction to Philosophy, 53–86;
Calkins, *loc. cit.*;
Hibben, Philosophy of the Enlightenment, Chap. V.

FOR THE STUDY OF SPIRITUALISM READ:
Calkins, Persistent Problems of Philosophy, Chaps. IV and V;
Hibben, Philosophy of the Enlightenment, Chap. III.

3. *Pluralism and monism.*—To the question, How many substances are there? those who hold the foregoing theories have given different answers. The dualist, of course, must hold to a plurality of substances. Those who hold the fourth theory have usually adopted monism, the doctrine that there is but one substance. But the materialists and the spiritualists have divided into the two sub-groups monists and pluralists, thus giving rise to the four hypotheses, pluralistic materialism, monistic materialism, pluralistic spiritualism and monistic spiritualism. The most famous type of pluralistic materialism is the atomic theory of Democritus and his modern followers. An example of monistic materialism would be the doctrine, the ether is a substance and all other entities such as the electrons, chemical atoms, molecules, and living creatures are reducible to vortices and to systems of vortices in the ether. The most familiar examples of pluralistic spiritualism are the theories of Berkeley and of Leibniz. Of monistic spiritualism the most prominent examples are the doctrines of the post-Kantian philosophers, Fichte, Hegel, Schopenhauer.

FOR FURTHER STUDY READ:
Calkins, Persistent Problems of Philosophy. Chaps. II–V, VIII–X;

Paulsen, Introduction to Philosophy, 207–243;
Hibben, Philosophy of the Enlightenment, Chap. VII.

FOR MORE EXTENSIVE STUDY READ:
Lotze, Metaphysics, Bk. I, Chaps. V and VI.

4. The relation between the substances.—Though the monist claims to escape the further problem, How are the substances related? he does so only by surreptitiously avoiding the problem. The pluralist cannot avoid the problem, and frankly endeavors to solve it. Yet so difficult is this problem that no less than three theories have been held, and all of these are manifestly inadequate. (a) *The interaction theory.*—The first and natural theory is that the substances interact. But more refined definitions and theories of substance make this impossible. A substance must be the *sole* subject, or ground of *all* its phenomena. If so, it cannot have phenomena partly caused by other substances acting upon it. (b) *Monadism.*—To avoid this difficulty, the pluralist may deny that there is any interaction or any interrelation, asserting that all seeming interaction and interrelation are an illusion of the human mind, and that each substance is really a little world by itself, completely isolated from all other entities. But this theory is met by the overwhelming difficulty that all the facts we do know point to interrelation and that the theory is consistent with no known fact and is therefore purely gratuitous. (c) *Occasionalism* and the *pre-established harmony.*—So serious is this difficulty that even the monadist has added to his theory the third theory, which asserts that the substances have no natural, but a supernatural interrelation. This supernatural interrelation may be twofold. Either God

in creating the monads or the substances *pre-established* their behavior for all eternity and thereby brought it to pass that for all time the substances behave as though they interacted; or God by a perpetual miracle or interference regulates each substance upon *each occasion* when we seem to see it interact, so that it behaves as though it did indeed interact. The former hypothesis is called the pre-established harmony. Its most famous advocate was the great German philosopher Leibniz. The latter is called occasionalism. It was held especially by some of the followers of Descartes who could not reconcile his dualism with the interaction of mind and body.

FOR FURTHER STUDY, consult references already given.
Consult also:
Russell, Philosophy of Leibniz.

5. The problem of change.—The substance hypothesis claims to account not only for the predicates things have but also for the changes that take place in these predicates. A knowledge of the nature of the substance will reveal not only its essence but will tell us why its accidental properties keep changing. But no substance hypothesis ever solved this problem, nor could it, for the reasons given in earlier chapters in discussing chance and evolution. However, attempts have been made leading to the following rival theories: (a) Change is an illusion; the substance is eternally the same. This theory is called eleaticism, from the name of the school of Greek philosophers by whom it was first maintained. (b) It is of the very nature of the substance spontane-

ously to produce new qualities and states. This doctrine is called dynamism. (c) The substance itself does not change. All that changes is the relation between the substances. These changes in relation give rise in us, as onlookers, to the illusion that the substance itself is changing its qualities. This doctrine is mechanism, named after its typical form, the world of mechanics taken as the complete story of reality. In mechanics the material particles alter their position relatively to one another, or, as it is usually expressed, the systems of material particles alter their configuration. This alteration, so the mechanist argues, is the only real change, all other changes being discontinuous and illusory.

Each of these theories is evidently insufficient. Change certainly exists, for it is revealed to us as fact and is never denied except in the interest of a theory. To say that it is the nature of the substance to produce change does not explain change. It simply admits that change is inexplicable. Finally, to admit that the relations between the substances change, even if all other changes are illusion, leaves the believer in the substance theory with the problem of change still on his hands, for why do these relations change? The only answer he can give is that change is ultimate and inexplicable. In short, *the various substance hypotheses do not explain change but leave us precisely where we started, with change ultimate and unexplained.*

CHAPTER XVI

IDEALISM

1. *Introduction.*—Idealism, the theory to be studied in the present chapter, is historically closely related to the substance hypothesis. The first idealists were the first destructive critics of the substance hypothesis, and their rejection of the notion substance led them to idealism. Logically, idealism arose as a theory regarding the nature of the phenomena which alone compose the world, provided substance does not exist. The various commonplace objects about us, with their many qualities and states, are the phenomena, let us say, of matter; but "what are they if there is no such substance as matter?" Even before this question was asked, some philosophers who held to the substance theory began to have difficulty in accounting for all the familiar qualities of material objects as genuine phenomena of matter. Is the sweetness of sugar a quality of sugar? Is the color of a red flag truly a quality of the matter of which the flag is composed? If it be so, why does the color change when we become color blind? Or when we look at the object from the side of our eyes? Is the warmth of water truly a quality of the water? If so, why can the same "tepid" water feel to one hand hot and to another cold? Similar questions were asked regarding odors and sounds. These so-called secondary qualities seemed to

depend largely upon the perceiving mind rather than upon the nature of the material object; for to the philosopher of the seventeenth century reflecting upon the nature of matter, the only way in which to account for such phenomena seemed to be to assert that they were merely *the effects* of the true properties of matter acting upon our minds. Thus Descartes held that matter has but two genuine properties, extension and motion, and that all the other familiar qualities of material things result from this moving matter acting upon our sense organs and giving rise in us to sensations radically different from it, their external cause. In short, colors, tastes, sounds, odors, heat and cold, are but mental states in the perceiving mind and have no existence outside that mind. This belief together with the growing disbelief in the existence of substance led to the rise of the idealistic hypothesis in the early eighteenth century.

2. *The idealistic hypothesis.*—The word idealism may be used in a broader or a narrower sense. In the broader sense, idealism asserts the proposition, "all facts are mental," that is to say, "all things which one perceives are but the states of the perceiving mind itself." When I see colored objects, what I see is only my sensory experiences of colors of certain shape and arrangement. When I feel the warm fire, what I feel is only a sensation of warmth. It may be caused by the fire, but whether it is or not, as perceived it is only my mental state. Again, when I hear another man speaking, the sounds being my sensations, are only my mental states. In short, *apart from my own experiences, my own mental states, I perceive nothing.* These mental states may be

caused from without and may, by their resemblance to external objects, reveal the nature of those objects; but never do the objects reveal themselves directly.

In the narrower sense idealism asserts the extreme hypothesis, "not only are all facts mental but so also is all existence." *To be is to be perceived, or to be experienced in some other way, and apart from experience there is nothing.* Idealism thus denies the existence of the physical world, that is, the existence of a world of material and physical agents and events apart from the mental states which we call our experience of this world. In our dreams it is said, the material objects perceived have no existence apart from the dream experience; so also have the physical objects of waking life no existence apart from the experiences of minds.

FOR FURTHER STUDY READ:

Berkeley, Dialogues between Hylas and Philonous.

3. The evidence offered in support of idealism.—To most idealists it seems self-evident that what we perceive is only our own mental states. Take any object and examine its sensible properties. Is not each quality as perceived but so much sensory experience of our minds? Take your perception of an orange. Consider the color, is this not a visual sensation which you now get and which you would lack if you were blind? Take the weight, the smoothness, the softness, and the taste; is not each but the sensation which your mind is now experiencing and which an injury to the special sense organs involved would quite annihilate?

As further evidence that what we perceive is only men-

tal, or subjective, our attention is called to the well known truths concerning perception, illusion and hallucination. It will suffice to mention a few of these; some have been already mentioned. There is the "distortion" of things as seen in perspective, the meeting of parallel lines in the horizon, the smallness of distant objects. There are the phenomena of refracted light, the straight stick partly immersed in the water but perceived as a bent stick. There are the changed colors and lessened detail of distant objects, the blueness of the distant mountain. Illusion and hallucination especially are regarded as unquestionable proof. There are the spatial and temporal displacements of the perceived. A thing looks far away when it is near. A sound is heard later than another which followed it. There are the qualitative illusions, of which the example previously cited is an instance, the tepid water cold to one hand, hot to the other. Finally, there are the hallucinatory experiences of normal life, of the man dreaming, of the delirious patient and of the insane. These cases, it is argued, form an overwhelming mass of evidence in support of the subjectivity of all that is perceived.

Such is the evidence for idealism in the broader sense. For idealism in the narrow sense, further evidence is offered, evidence which is said to prove that nothing exists apart from the mind's experience. One argument which appeals strongly to some idealists is based on the conviction that the mind cannot "transcend itself" by knowing what lies outside or beyond the mind. How can the mind know a distant world? Even if the distant world is, spatially considered, only a few yards from my

body, it is as inconceivable for the mind to know the world as it is inconceivable for me to get to London without passing through the intervening space. What is not in the mind is as such unknowable; therefore to insist upon the existence of a world outside experience is to assert the existence of a totally unknowable world. Even that such a world exists about us is more than the mind can know. In short, to assert the existence of such a world is to talk nonsense, it is to go beyond all possible knowledge. This argument sometimes takes a shorter form: what I know to exist I must have in some way experienced; and since I never know of an existent apart from my experience, all existence must belong to experience.

A more forceful argument is one used especially by English idealists. Analyze any existential proposition and it will be found to be only an assertion of future possible percepts. If I say there is a hat in this box, I mean that if I open the box I shall see a hat there. If I hear a noise and assert there is a wagon passing the house, I mean that if I go to the window and look out I shall receive such and such visual sensations. If I believe that Charles the Great lived in the eighth century, I mean that such and such possible percepts are *now* to be had, percepts which we often refer to as the evidence of his existence. In short, "to exist" means "to be a possible experience."

Finally it is urged that the world itself bears the marks of being the mind's experience. Space and time are shown to be forms of our perception, that is, peculiar ways in which the mind of man does its perceiving. They are like the blue spectacles a man may wear and

thereby make the world blue, except that these spectacles, space and time, cannot be taken on and off. That is, the world is for us a world in space and time solely because from the constitution of the mind, in order to be perceived and thought, it must be perceived and thought as a spatial and temporal world. The same is true of the causal order of the world. This order is but the way in which our minds have to order their experience; indeed some philosophers reduce causation to the working of the familiar psychological law, the law of association. For example, I believe fire will burn because I have associated burning with fire. I believe that thunder and lightning are causally related because I have associated the two together. But a full statement of this last argument leads us into questions which must be reserved for a later chapter. Suffice it to say here that for two hundred years one or more of the foregoing arguments have seemed to almost all philosophers sufficient proof of idealism either in the broader or in the narrower sense. We must now consider the validity of these arguments.

4. *The refutation of the idealistic hypothesis.*—In general, it must be said that though the way to idealism is easy and the arguments in its behalf are wonderfully persuasive, idealism is the most remarkable instance of human self-deception which the world has ever seen. For two centuries it has been believed without question by most philosophers, including, indeed, many of the ablest and profoundest thinkers of all time. In particular we must consider each type of argument and point out its error.

(a) *It is not self-evident that what we perceive is only our own mental states.*—Rather precisely the opposite is evident. What we perceive are things and happenings in a physical world. Such is the verdict of common sense; and such also is unquestionably the verdict of perception itself if we keep all other matters out of consideration except the actual perceived content. Only after we have become prejudiced by a study of other problems and have become thoroughly sophisticated thereby does any such feeling of self-evidence as that claimed for idealism get the better of our natural common sense. The sensible qualities of things, such as their color, their smoothness, their weight, their temperature, are always asserted as properties of the things themselves by mankind at large and by the idealist himself when not speaking *ex cathedra*. Indeed it requires a high degree of ingenuity to free perception from the charge of universal falsehood in case idealism be true.

(b) *Do the facts connected with perception, illusion and hallucination give the evidence which perception itself certainly does not give?* The argument from the familiar phenomena of perception, illusion and hallucination is also a most astonishing misinterpretation of fact. It is so for the following reasons: First, the idealist assumes naïvely that no other theory but his own can account for the phenomena of perspective, and the phenomena of illusion and hallucination. Secondly, he seems utterly blind to the truth that his idealism does not really offer any solution whatsoever of the problems raised by these phenomena. As to the first matter, the phenomena of perspective are not peculiarly human, not to say, men-

tal. Every photograph reveals the same phenomena. In short, they are thoroughly physical. So also are the phenomena of refraction; the bent stick seen in the water, if the idealist's argument were valid, would prove even that the camera is a mind and its altered sensitive plate a mental state. Similar truths hold regarding other familiar cases of illusion. Indeed, if the so-called secondary qualities were mental and not physical, the science of physics would almost have to be abandoned, for the major part of its subject matter would be taken from it. As to the second matter, idealism has never given the world the slightest hint, not to say account, of how these phenomena of perception, illusion and hallucination are to be explained. The only explanations we have, come from physics and physiological psychology, where the scientist is taking for granted that he is explaining the mental phenomena by means of physical and biological phenomena, and where he certainly is not taking it to be true that he is explaining one mental state by means of other mental states. In other words, the idealist uses the problems of perception and illusion to prove idealism; and then, after he feels that his idealism is established, he throws away the problems.

(c) The third type of argument involves matters to be discussed in the following chapter, so only some of its special forms will be now considered. Whatever may be the meaning of the words "to exist," usually when we assert existence, we do not mean to predict possible percepts. When I say that there are submerged mountains in the Pacific Ocean, that there are waves in the ether, that Brutus was present at the killing of Cæsar, that I

had a dream last night, I am certainly not asserting directly any proposition about future percepts, or possible percepts. The very talk about possible percepts and future percepts is itself an existential judgment regarding percepts; for if "to exist" is "to be a possible percept" what do I mean when I say "percepts exist"? Existence as a notion is logically prior to perception and certainly to the propositions which predict percepts. In short, the notion "to exist" cannot be defined in terms of the notion "to be perceived," as has been so widely held by English idealists since Berkeley. A similar truth holds regarding the other fundamental terms of science such as space, time and causation. They certainly cannot be defined in terms of the mental without a vicious circle; nor can they be reduced to mental laws or forms of perception without the most disgraceful abandonment of logical rules. Moreover, a study of the spatial, temporal and causal aspects of facts does not reveal anything mental. It reveals rather the properties of space, time and causation, and "mentality" is not one of these properties. If it were so, would not those sciences which especially study space and time, for example, mathematics, be obliged to indicate this, which they certainly do not? In general, what we believe or what we must believe because of the nature of our minds has nothing to do with the truth or falsity of this or that proposition, nor does it give or withhold existence to the major events and aspects of the physical world. That anyone should ever have believed so is due to erroneous theories, to be studied in the next chapter, regarding the logical priority of the science of knowledge.

FOR FURTHER STUDY READ:

Moore, The Refutation of Idealism, *Mind*, 1903, XII;

Montague, The New Realism and the Old, *J. of Philos., Psychol., etc.*, 1912, *9;*

Alexander, On Sensations and Images, *Proc. Aristotel. Soc.*, 1909–10, *10;*

Nunn, Are Secondary Qualities Independent of Perception? *Proc. Aristotel. Soc.*, 1909–10, *10;*

Wolf, Natural Realism and the Present Tendencies in Philosophy, *Proc. Aristotel. Soc.*, 1908–9, *9;*

Moore, Nature and Reality of Objects of Perception, *Proc. Aristotel. Soc.*, 1905–6, *6;*

McGilvary, The Stream of Consciousness, Prolegomena to a Tentative Realism, and The Physiological Argument against Realism, *J. of Philos., Psychol., etc.*, 1907, *4;*

McGilvary, The Relation of Consciousness and Object in Sense Perception, *Philos. Review*, 1912, *21;*

Smith, Norman, Subjectivism and Realism in Modern Philosophy, *Philos. Review*, 1908, *17;*

Perry, Present Philosophical Tendencies, Pts. III and IV.

FOR MORE EXTENSIVE STUDY READ:

Case, Thomas, Physical Realism;

Fullerton, System of Metaphysics, Pts. I and II.

The New Realism, essays by Montague, Holt and Pitkin.

APPENDIX TO CHAPTER XVI

IDEALISTIC HYPOTHESES

1. *Introduction.*—Various idealistic hypotheses have been held regarding the nature of reality; and many of these have played an important part in the history of modern European thought and continue to do so. Chief among these hypotheses are (a) Representative Realism, (b) Phenomenalism, (c) Subjective Idealism, (d) Objective, or Absolute Idealism.

2. *Representative realism and phenomenalism.*—Representative realism is best illustrated by the familiar doctrine that the physical world consists solely of particles of matter with their motion, and the ether with its undulations, whereas all other aspects and qualities of the natural world consist solely of the mental states caused in our minds by the action of the ether and particles of matter upon our organs of sense. Nature as revealed to our perception has colors, but these colors are subjective or mental states in us. What truly exists without the mind is the undulatory motion in the ether which gives rise to color sensations by stimulating the nervous system. In short, "if minds and their mental states should be annihilated, there would exist only the ether and its undulations, the particles of matter and their motion, or whatever other entities turn out to be the 'ultimate physical objects.'"

Phenomenalism [1] goes a step farther. Even the physical world is mental. All that we can perceive and know is but what we experience through the action of unknowable entities upon our minds. That is, the mind is, as it were, at the central station of a telephone system (evidently our nervous system is what is meant) through which it is receiving messages from an outside world. From the nature of the case it has never, and can never, leave this central station and can therefore never perceive those who are sending in the messages, the world of which they are members, or the world of which they speak. The messages then alone are all that we perceive; their authorship is not only unknown to us, but unknowable. As the man blind from birth can by no conceivable means gain a picture of the sun whose warmth he feels, so we can never perceive or even conceive the nature of that world without us by whose agency we have the sensations and percepts which we experience and call the world. Not only is this true of the world without the mind but it is true even of the mind upon which this unknowable world is supposed to act. We perceive its states, its sensations and feelings; but we can never perceive it, the subject of these states.

As the real objective world is believed to exist but is declared to be quite unknowable, we are left in a situation which cannot but provoke guessing, no matter how impossible it is to verify the resulting guesses. And the ingenious philosophers among the phenomenalists have not been idle.

[1] Many use this name to denote also representative realism.

FOR FURTHER STUDY READ:

Calkins, Persistent Problems of Philosophy;
Smith, Norman, Studies in the Cartesian Philosophy;
Pearson, Grammar of Science, Chap. II.

FOR MORE EXTENSIVE STUDY:

The writings of Descartes, Locke, Kant and Schopenhauer.

3. *Subjective and objective idealism.*—Subjective idealism goes one step farther. Not only is all that we experience mental, not only is the external world unknowable, but there is no external world. There exist mind and its experience or minds and their experiences. The existence of a transcendent world or world of things in themselves apart from experience is a meaningless statement. To be or to exist means, as such, to be for some mind.

The most familiar instance of subjective idealism is the idealism of Bishop Berkeley. According to this philosopher there exist God, the infinite spirit, and the finite spirits He has created. The world exists only as the thoughts and percepts of God and of the finite spirits. The world differs from a mere dream solely through its law and order which are due to God, He being on the one hand the source of all the percepts which the finite spirits experience and on the other hand the guarantor of the reign of law.

Whether or not the world conception of the German philosopher Fichte can rightly be called subjective idealism, his doctrine was at least so interpreted by his immediate successors and may be used here to illustrate further the doctrine of extreme subjectivism. There exists only the "absolute ego." This ego creates the

experience of an external world of physical objects in order that the moral struggle of life may take place. The end and purposes of life are this moral victory of the self over a world, or not self, of which the self is the ultimate author; for the existence and the significance of the physical world are due solely to this ultimate act of the will. In short, the will wills a world in order to overcome the world.

Objective, or absolute idealism arose as a reaction within idealism against this extreme subjectivism. Though all that exists is experience, still what you and I experience is only a part of the total experience and may be largely subjective. Reality is a complete or absolute experience, whereas a man's experience is fragmentary, relative and incoherent. Perhaps the easiest way to picture the absolute experience which coincides with reality is this: You and I mean by the world not what we have experienced or do experience but what we should experience if we knew everything and knew it fully and perfectly. In other words, reality is the absolute goal or final stage in the evolution of that knowledge which began in our babyhood and which has made some progress along its ideal pathway in the intervening years. From a study of this, its progress, we can infer the nature of its ideal goal, its perfect consummation. Reality is that perfect and absolutely coherent experience in which all error and incompleteness, that is, subjectivity, has passed away from experience and in which experience has become absolute or objective. Objective idealists differ as to whether or not this ideal experience actually exists in an absolute mind, namely God, and so

as to whether or not it is merely an ideal of the finite minds toward which they can progress but which will never be realized. In any case the finite experiences of men are but parts of this one all inclusive experience.

Thus objective idealism does overcome some at least of the subjectivism of other forms of idealism. The world is not a mere collection of the mental states of whatever minds happen to exist. It is an absolute system quite distinct from these experiences though most intimately related to them by being their ideal goal. The objects of the world do not then depend upon us for their existence, for they exist regardless of whether we experience them or not. Their existence depends solely upon whether or not they would be experienced were our experience complete and perfect. Still, of course, it remains true that all reality is nothing but experience, the experience of the absolute mind.

FOR FURTHER STUDY READ:

Berkeley, Dialogues between Hylas and Philonous;
Berkeley, Principles of Human Knowledge;
Fichte, Vocation of Man;
Haldane, Pathway of Reality;
Taylor, Elements of Metaphysics, Bk. II, Chaps. I–III.

FOR MORE EXTENSIVE STUDY READ:

Münsterberg, The Eternal Values;
Royce, The World and the Individual;
Ward, Naturalism and Agnosticism, Parts IV and V;
Bradley, Appearance and Reality;
Taylor, Elements of Metaphysics.

CHAPTER XVII

DOGMATISM VS. CRITICISM

1. *Introduction.*—If we look into the mind of a young child, psychology tells us, we shall find that he perceives a world about him radically different from that which the adult man perceives; for our adult perceptions are the result of years of training and experience in reacting to and experimenting with the commonplace objects of our environment. The infant does not see things at a distance in any such discriminating way as does the adult, nor are the relative sizes of the familiar objects apparent to him. To us fire "looks" hot, ice "looks" cold, rocks "look" hard and heavy, water "looks" a fluid, and the wind "sounds" cold and raging. To us, familiar objects are quite complex as to their parts, qualities, relations and other properties. A man is seen to have a nose and a mouth, eyes and ears, hair and hands, to be wearing a hat and coat, to be old or young and strong or feeble. Some of us remember when distant men and houses were believed to be literally as small as they appeared. How different, too, music sounds after we have been trained in music, from what it did before; and how different a machine looks to the mechanical engineer from what it does to the layman! Again, could we but see into the mind of a dog or cat, would it not be similar to entering another world; for

their world is a world of far fewer objects and of objects which are far less complex in their qualities and in their relations? In short, must not the world which is asserted as the real world by each human mind be markedly peculiar and unlike not only the world asserted by the higher animals but even by fellow men?

Thus we may not only infer that there are as many worlds as there are minds capable of perceiving and judging, but also go farther and conclude that the conception of a real world totally independent of each man's peculiar world is for him impossible. The so-called real world which exists regardless of my mind is for *my* thought merely *my* own world explored and studied till I feel that I have done so exhaustively. For example, if I am blind and try to conceive the world perceived by those who see, I have to build up my notion of such a world entirely from my own world; and therefore it never becomes truly a world of light and color just because my world is totally lacking in these attributes. Further evidence supporting our general conclusion is to be found everywhere we turn. Even the most perfect and rigorous sciences are stamped with the human trademark. Those aspects of man's world which are most important *for man* or most interesting *to man* or most apparent *to man* are the ones that have received man's study. Applied science is the mother of pure science; and the possible future application of pure science adds greatly to its interest and pursuit, for a world revealed by pure science and totally lacking elements of human interest would be ignored by man as our scientific world is ignored by the dog and the horse. In short, even as

philosophers, we view the world through human spectacles and we can no more discard these spectacles in our intellectual enterprise than we can totally discard the instincts and other traits which govern and foreordain the chief directions of human practical life. To view the world as it is or regardless of the human point of view is not only an impossible undertaking but an absurd endeavor.

From this it is argued that we must draw the following conclusion: In order to know and to understand the world of which we are a part and in which we live and move and have our being *we must first know and understand the mind which is to do the knowing and the understanding*. Not as we once believed, first understand the world and then you can understand man and his mind; rather, understand first man and his mind and then you can understand the world. Thus the theory of the mind and of the knowing process is the fundamental science and the true basis of a scientific conception of reality. It is the *fundamental science because the various sciences take their form, get their postulates, and have their goal chosen for them by the minds of the individual scientists, and because on this account the study of these minds will reveal the foreordained character of the sciences.*

2. *Criticism.*—That there should be a science of man's intellect and of the nature of his knowledge (called the theory of knowledge, or epistemology), no one will question. But philosophers differ radically in their answer to the question: Is this science truly fundamental, forming the basis of all other science? Idealists usually answer this question affirmatively. Moreover, they find in the

science of knowledge a powerful body of evidence in support of idealism itself; and with their idealistic bias they behold in this science a means to work out *a priori* a theory of reality which will make the mind the centre and the controller of reality. On the other hand, those who deny that the theory of knowledge is fundamental believe that the idealists are here guilty of a grievous logical treason whereby, through a *coup d'état*, a perfectly legitimate special science has been raised by them from the humble rank of a private citizen in the world of science to be the infallible and supreme autocrat and judge over all the other sciences.

As a result of this logical revolution we have no longer a special science on our hands; for the science now studies the nature and growth of man's knowledge in order to learn the nature of reality, in order to learn whether or not matter exists, whether or not space and time are real, whether or not the world is a causal system, whether or not there can be any world beyond our experience, whether or not religion and morals are valid, whether or not God exists. It has even trespassed upon the fields of the special sciences. It has been ready to dispute with mathematics about the nature and validity of the infinite and the continuum. It has attempted to work out from the nature of man's intellect the fundamental postulates of mechanics and physics. Indeed a careful search through all the volumes devoted to its teachings would probably find few special fields where it has not trespassed.

For the past two hundred years the theory of knowledge has been the most prominent department of

philosophy; and it has been so because philosophers have held this remarkable belief regarding its place among the sciences. It has supported idealism and idealism has supported it, until the attempt to separate the two is very difficult. Hume and Kant, the great fathers of nineteenth century philosophical thought, were its sponsors and they gave metaphysics almost entirely into its care and keeping. Indeed, for the past one hundred and fifty years metaphysics has been virtually identified with the theory of knowledge, and many philosophers to-day hardly distinguish between them.

In general, I call this transformation of epistemology into a metaphysics and a theory of reality, *Criticism*. Opposed then to criticism is the doctrine that epistemology is but one of the special sciences and is neither metaphysics nor in any way a fundamental science. This doctrine, which I now proceed to defend against criticism, I call *Dogmatism*. Before proceeding, however, let me make the doctrines of the rival standpoints explicit by summing them up in two sets of propositions.

FOR FURTHER STUDY READ:

Paulsen, Immanuel Kant;
Fischer, Kuno, Geschichte der neuern Philosophie, first volume on Kant;
Kant, Critique of Pure Reason (Watson's Selections);
Kant, Prolegomena.

3. The issue between criticism and dogmatism.—"Criticism maintains one or more of the following propositions: first, that in general the theory of knowledge is logically fundamental or prior to all other sciences and to all other scientific procedure; secondly, that the theory

of knowledge can ascertain the limits of the field of possible knowledge; thirdly, that it can determine ultimately the validity of science and of the methods of science and can correct the results of science with the authority of a court of final resort; and finally, that it can give us of itself certain fundamental, existential truths, a theory of reality. In opposition to these claims, dogmatism maintains: first, that the theory of knowledge is not logically fundamental, that it is simply one of the special sciences and logically presupposes the results of many of the other special sciences; secondly, that the theory of knowledge is not able to show, except inductively and empirically, either what knowledge is possible, or how it is possible, or again what are the limits of our knowledge; and, finally, that it is not able to throw any light upon the nature of the existent world or upon the fundamental postulates and generalizations of science, except in so far as the knowledge of one natural event or object enables us at times to make inferences regarding certain others; in short, that the theory of knowledge does not give us a theory of reality, but, on the contrary, assumes a theory of reality of which it is not the author."

4. The refutation of criticism.—(a) Criticism maintains that the study of knowledge is logically fundamental or prior to all other sciences. But this is absurd, because if it were true then a student knowing absolutely nothing about logic, about physics, or about biology, that is, about man's life and his environment, could discover the nature of knowledge, the factors which determine the growth of knowledge and the validity of knowledge. Evidently such an independent study of the knowing

process is impossible. Whatever we know to-day regarding the nature and conditions of our knowing has come through a long study not only of man and his mind but also of the environment in which that mind has its existence, of the world to which that mind has to react and to which it has to adjust itself. In short, instead of the theory of knowledge indicating to us what the world must be in order to be known, the truth is precisely the opposite. Learning what the world is, has enabled us to learn what man's knowledge is, what its function is, what its origin and conditions are. Thus the theory of knowledge, instead of being a fundamental science, presupposes the results of almost all the sciences, certainly the results of logic, physics, biology, psychology, social psychology and the history of science.

(b) Again, criticism, in maintaining that a study of the nature of knowledge can ascertain the limits of the field of possible knowledge, is asserting what is untrue. By no known means can I learn from psychology, or any other study of the knowing process, what problems, let me say, of physics or physiology, will prove insolvable. Of course, some things may indeed be for man quite unknowable; but if we can learn what these things are, we must do so by first learning a great deal about the world which we do know. "In case after case man has been able to discover what scholars in an earlier age pronounced unknowable, or would have pronounced unknowable if the question had so much as entered their minds. This has been true of what man has learned precisely as a similar truth holds regarding what he has proved himself able to do in spite of an earlier belief

that the deed was impossible. We have been able to see the far distant and the exceeding small, where centuries ago such vision would have seemed impossible. We have been able to study the chemistry and the temperature of the stars, we can weigh the planets, we can tell with complete accuracy the area of curved figures whose sides stretch out to infinity. In short, precisely as the wireless telegraph and telephone, X-ray photographs, and trolley cars would seem miracles to Galileo could we suddenly usher him from the seventeenth century into the twentieth; so too what has proved possible for man to learn since his day would seem to him miraculous."

(c) Thirdly, criticism maintains that by studying the nature of knowledge we can determine ultimately the validity of science and of the methods of science and correct the results of science with the authority of a court of final resort. Evidently this cannot be so if the science of knowledge is logically indebted to the sciences which it criticises, for such a procedure would be a flagrant vicious circle. In the course of its growth science does often find its theories to be erroneous and its methods to be inadequate; still the way in which this is discovered is not by studying the nature and faculties of the human mind, but by studying the things themselves, the facts. If a theory is false, some crucial experiment reveals facts which contradict it. If a method is inadequate, its results show its inadequacy, or a more critical insight reveals the fallacy involved in the logical presuppositions of the method. Our scientific methods, our precise instruments for observation, for measurement, and in general for experimentation are not the inventions of

psychologists and epistemologists but of the men actually working in the field of the special sciences.

(d) Finally, criticism in maintaining that the theory of knowledge can give us a theory of reality is again guilty of an evident vicious circle. No theory of knowledge has ever been formulated which upon careful analysis does not betray that it presupposes logically some theory of reality, usually the theory of reality current in the day and generation of its author. In other words, the epistemologist has borrowed his theory of reality from the sciences and then after reading it into his theory of knowledge, has read it out again. Moreover, such attempts to discover through the nature of knowledge the nature of the world have been a dismal failure. Idealism is the chief result of these attempts, but I refer especially to those attempts which have led to doctrines of causation, of space and time, of matter, and of other things which belong to the field of the special sciences. The history of philosophy from the days of Descartes to our own is full of such theories which have sooner or later met shipwreck. The rock upon which they have run, a harder rock than any epistemological theory, is fact. Fact and fact alone can give, test, and validate existential hypotheses. Therefore the sciences most closely in touch with any field of fact are alone the sciences which have prior right to offer us existential theories belonging to that field. Thus when epistemology commences to be a physics or any other special existential science outside its proper field, we have a right to expect what we usually get, outworn, discarded, and, in general, erroneous theories.

5. *Conclusion.*—We must conclude then: Though "a correct epistemology can be full of valuable suggestion to the metaphysician, this science is in no peculiar respect nor to any peculiar extent fundamental to metaphysics. It is not peculiarly a part of metaphysics nor is it in any respect to be identified with metaphysics. On the contrary the truth is that epistemology is not a logically fundamental science, that the solution of the problem of the possibility and the limits of knowledge is logically subsequent to some at least of the special sciences, that epistemology cannot furnish us with a theory of reality, that metaphysics owes logically neither its problems nor their solution to the theory of knowledge."

FOR FURTHER STUDY READ:

Woodbridge, Field of Logic, Congress of Arts and Science, St. Louis, 1904, Vol. I;

Marvin, The Emancipation of Metaphysics from Epistemology, in The New Realism, New York, 1912.

APPENDIX TO CHAPTER XVII

THE METAPHYSICS OF CRITICISM

1. *Introduction.*—As the subject of epistemology lies quite beyond the plan of this book, only the briefest outline of the different epistemological theories will be given here, and this will be done solely because criticism has transformed these theories from legitimate inductive studies into fundamental metaphysical hypotheses. Considerable confusion is inevitable because these theories have become closely associated with metaphysics and chiefly because current usage employs many technical names for radically distinct theories. The student is especially warned not to confuse many of these names with the same names used in preceding chapters to denote radically distinct metaphysical theories, especially the names, romanticism, rationalism, empiricism, realism. Of course, these common names point to a common historical origin of the different theories and to a continued confusion of these theories in the minds of philosophers. I shall not argue for or against any of the different epistemological doctrines, but shall rest satisfied that all forms of criticism have been refuted, no matter what epistemological standpoint they represent, and that certain epistemological theories are shut out by the metaphysics of those sciences which are logically prior to epistemology.

2. *A classification of epistemological theories.*—In gen-

eral, the following problems arise when we study the knowing process. (a) What is the function of knowledge? Why does it exist? (b) Through what mental faculties do we get our knowledge? (c) What is the relation between the perceiver or knower and the object perceived or known? (d) What degree of certainty is attainable by human knowledge, the nature of man's mind, its origin and its growth, being what they are? This problem may be called the problem of the validity of knowledge. (e) Finally, the mind and its powers of knowing being what they are, what are the limits of human knowledge?

(a) *The function of knowledge.*—Regarding the function of knowledge two prominent theories are entertained. According to the first, knowing is an end in itself. It is an ultimate *sui generis* capacity of man and is independent of his biological history. This doctrine may be called *Absolutism.* Some call it Intellectualism, but I shall reserve this name for another doctrine. According to the second theory, knowing is a vital function, as are breathing, digesting, moving the arms and legs. It is a means of adjusting the human organism to its environment and, in general, a means of satisfying the instinctive and acquired needs of that organism. Knowledge for its own sake exists only in the sense that loving and hating, breathing and walking exist for their own sake. This doctrine is called *Pragmatism.*

(b) *The source of information.*—Regarding the source of information two radically different theories obtain. By the *romanticist* it is denied that the intellect is a means by which we acquire true knowledge. Perception and especially feeling alone reveal reality. The work of the

intellect is not to give us truth but solely practical devices by means of which conduct can be guided. For example, such a knowledge as that of the abstract laws of mechanics is only a means by which we construct machines and do other useful things. It is not a genuine knowledge of the nature of the real. In general, science is not truth but a practical device.

By the *intellectualist* it is affirmed that not only the perceptual experience but also the conceptual experience of mankind is a genuine means of acquiring information. The intellectualists are divided among themselves into two groups. First, there are the *empiricists* who maintain that the sole source of the conceptual experience is the perceptual. That is, our conception of space, of cause and effect, of matter, of number or of any universal has arisen from our sensory experiences by processes which the psychologists call analysis and association. Secondly, there are the *rationalists* who maintain that the intellect or reason is itself the direct source of all or at least of some concepts. Of the extreme rationalists Plato is the most famous among ancient philosophers. Among modern rationalists Kant is the one most widely studied and followed. His theory is called *transcendentalism*. It teaches that the content of our experience comes from our outer and inner perception, but that the general form of experience is given by the mind. More in detail, space and time are the forms of perception, causation and certain other laws are the forms of the understanding. In calling space and time forms of perception Kant means that it is not due to the content perceived but to the mind that the sensory world is a world in time and space; and

in calling causation a form of the understanding, he means that the mind does not receive its experiences ordered causally or cosmically but that it is due entirely to an activity of the mind that the world appears to us a world and not a chaos of sensory elements.

(c) *The relation between the perceiver and the perceived.*— Here also two major opinions obtain. The first theory is that of the *epistemological monists* who maintain that we perceive immediately the objects of the world. The second is the theory of the *epistemological dualists* who believe that we perceive not the objects of the world but only the mental states to which these objects give rise in our minds. For example, the colors I see are only mental states caused in me by some external agent stimulating my sense organs.

Each of these groups is again subdivided. The epistemological monists are divided into *the natural*, or *naïve realists*, and *the subjectivists;* the dualists are divided into *the representative*, or *inferential realists*, and *the phenomenalists.* (1) The naïve realists believe that we perceive immediately the external, physical world. (2) The subjectivists believe that we perceive only our own mental states and that these constitute the external world. In other words, they are idealists and deny the existence of anything but minds and their experience. (3) The representative realists also are idealists (in the broad sense) but maintain that there is an external world whose nature can be inferred from our experiences. (4) The phenomenalists deny this last, believing that the true external world may be totally unlike anything which we experience or are capable of

even conceiving. Finally the subjectivists are themselves subdivided, as we already know, into the two idealistic groups, the subjective and the objective idealists.

(d) *Regarding the validity or certainty of our knowledge* three beliefs have been entertained. (1) *The absolutist* (a second meaning of the word) maintains that part of our existential knowledge is infallible and even that the general structure of the universe can be known deductively from infallible existential axioms. (2) *The empiricist* (a second meaning of the word) maintains that all existential knowledge (or virtually all) is got inductively and can be verified only by the trial and error method. At best our existential knowledge reaches a high degree of probability in the more exact experimental sciences. (3) *The skeptic* (or better the absolute skeptic) denies that our minds have power of knowing reality at all and therefore asserts that we can never reach any degree of certitude in our existential knowledge.

(e) *The limits of knowledge.*—It is difficult to distinguish this problem from the others and especially from the problem immediately preceding. Still none of these divisions is logically rigorous, for all are matters of usage and history rather than of final and rigorous analysis. The problem is, *How much* can we know, our cognitive faculties being what they are? (1) *The gnostic* (if I may here adopt this name) believes that we are able (as far as our faculties are concerned) to know everything that there is to know. Practically, of course, there are many things which we are unable to find out but that we are quite capable of ascertaining were it not for lack of instruments or other devices. For example, a thousand

years ago men had the faculties by which to see the microscopic, but lacked the instruments. To-day we have the faculties but not the means to see the other side of the moon or the centre of the earth. (2) *The agnostics* claim that there are certain ultimate problems which are essentially unknowable, man's faculties being what they are. We cannot know the ultimate ground of the world; or as they were fond of expressing it, we can know only the relative, not the absolute. The phenomenalist must of necessity be an agnostic. (3) Finally, we shall have to mention here too *the skeptic*, for he would maintain that all existence is beyond our powers of knowing. His then is a third position. All this uninteresting classification of epistemological theories can be seen more clearly in the diagram on page 217.

3. *The metaphysics of these theories.*—It would be largely a repetition of what has been said in several previous chapters to point out the various metaphysical hypotheses which are presupposed in, or have, historically speaking, risen from, these many epistemological theories. Idealism is evident, as are also many other issues, for example, that between romanticism and its metaphysical opponent, that regarding the perception of universal truths, that regarding the possibility of deducing reality from universal causal laws. In general, it can be said that the epistemological theories of the past three hundred years, from Descartes to our own day, are inextricably intertwined with metaphysical and therefore non-epistemological doctrines. The dogmatist believes that this is greatly to be lamented and that it has wrought much harm to the progress of both sciences, even bring-

EPISTEMOLOGICAL THEORIES

1. Function of Knowledge
   - Absolutism (first sense)
   - Pragmatism
2. Source of Information
   - Romanticism
   - Intellectualism
     - Rationalism
       - Transcendentalism
       - Empiricism (first sense)
3. The Relation of Perceiver and Perceived
   - Epistemological Monism
     - Natural (naïve) Realism
     - Subjectivism
       - Subjective Idealism
       - Objective Idealism
   - Epistemological Dualism
     - Representative (Inferential) Realism
     - Phenomenalism
4. Validity of Knowledge
   - Absolutism (second sense)
   - Empiricism (second sense)
   - Skepticism
5. Limits of Knowledge
   - Gnosticism
   - Agnosticism
   - Skepticism

ing both of them into disgrace in the eyes of other scientists. Metaphysics must be freed from this baneful alliance and so too must epistemology. Metaphysics must be purged from all traces of criticism, and epistemology must take its place as one of the special sciences among the other special sciences. It must return to an open-minded and modest empirical and experimental study of the facts involved in knowing. Metaphysical and dialectical controversies have no more place here than in any other special science; and a substitution of them for study of fact should have no place whatever. When epistemology frees itself from this entanglement there will no doubt be a very different set of epistemological opinions from the foregoing to be classified. Many of them will remain solely as interesting historic relics, and the others will cease to have their present metaphysical connotation.

FOR FURTHER STUDY READ:

Paulsen, Introduction to Philosophy, Part II;
Smith, Norman, Studies in the Cartesian Philosophy, Chap. I;
Dewey, Influence of Darwin on Philosophy and Other Essays;
James, Pragmatism;
James, Meaning of Truth;
Russell, Philosophical Essays, 87–149;
Stein, Philosophische Strömungen der Gegenwart, 33–75;
Moore, Experience and Empiricism, *Proc. Aristotel. Soc.*, 1902–3, *3;*
Liebmann, Zur Analysis der Wirklichkeit, 1ster Abschnitt;
Boodin, Truth and Reality;
Spencer, First Principles, Part I;
For references to classical writings cf. Paulsen, *loc. cit.*
For further references to recent books and articles, cf. references given in Chap. XVI.

PART IV

PROBLEMS IN SPECIAL METAPHYSICS

Each of the chief branches of science such as logic, mathematics, physics, biology, and pyschology raises metaphysical problems peculiar to itself. These problems being special to parts of science are called special metaphysics in distinction from the general metaphysics of the preceding chapters.

To be a student of special metaphysics one must be acquainted with the sciences whose metaphysics is under discussion, for one must consider critically the detailed results of the sciences and the evidence supporting their special metaphysical hypotheses. Without such knowledge the problems cannot but be obscure and in many cases unintelligible. Therefore where the student lacks this knowledge completely, he should not fail to read before studying each chapter some popular book or article on the nature of the science in question.

Unfortunately special metaphysics is still little studied in college courses; but it is to be hoped that students of metaphysics in the years to come will again be what metaphysicians were in centuries gone by, masters of one or more of the special sciences, and that in this way the workers in metaphysics may come in closer touch with the workers in these sciences and so become of genuine assistance to them. The following chapters are written to invite and to encourage the student of philosophy to enter the study of special metaphysics. Each chapter will deal with only a few problems and will serve only as the briefest introduction, leaving the student to continue his study by reading some of the writings recommended.

CHAPTER XVIII

THE LOGICAL

1. *Introduction.*—In formal logic two prominent special metaphysical problems have to do, (a) with the subject matter of logical study, that is, with the nature of formal logic, and (b) with the relation between the doctrines of formal logic and the existent.

2. *The subject matter of formal logic.*—In the past one hundred and fifty years logic and the psychology of the knowing processes have been confused, and many philosophers still neglect to distinguish between them. As a result of this confusion, the postulates of logic are often called "laws of thought," as though they were mental laws in the sense in which the law of association or habit, or the law of inborn connections is a mental law. Further, logic has been thought of as the science of how we reason, as the science of how our knowledge gets built up, as the science of how we form general and abstract ideas. Whereas logic is nothing of the sort. The postulates of logic are not laws of thought, not more so than is the law of gravitation. Logic does not study the mind nor any of the thought processes nor has it anything especially in common with psychology. The two sciences are absolutely distinct.

Logic is "the study of the various general types of deduction." As such it studies those general properties

of propositions, of classes and of relations, knowledge of which enables us to infer the truth of one proposition from the truth of other propositions. Such a study is of entities and relations which are quite non-mental and non-human in the same sense as is a multiplication table or the value of π. Moreover, these entities and relations are discovered as truly as America was discovered by Columbus; for they would be there to be discovered if man and his mind had never existed, precisely as would be the functional relation between the pressure and the volume of a gas or between the speed of the earth and its distance from the sun.

The confusion of logic with the study of man's reasoning processes has probably arisen from the fact that we always use logical information in our reasoning. But it should have been noticed that in our reasoning we use also other bodies of information, depending upon the topic under study, and that we use logic precisely in the same way in which we use this other information, that is, we use the truths of logic as premises. For example, we use logic in the same way in which we use physics. "We make use of the laws or propositions of physics as *premises* or as *formulæ for whose variables we substitute constants*. Let me illustrate. I want to know how far a projectile will go if it leaves the ground at a given angle and at a given velocity. Physics gives me formulæ which if I use as premises along with the given conditions also used as premises, I can infer the proposition which I wish to know. Again, mathematics tells me $(a+b)^2 = a^2+2ab+b^2$. I want to know the square of 27. How then do I use (*in my reasoning*) this information? We

substitute, let us say, for a 20 and for b 7; that is, we substitute constants for the variables in the equation. Thus $(20+7)^2=400+280+49=729$. Hence *to use* physics or any other exact or natural science *in our reasoning* is to adopt its propositions as premises. The same thing is true when we *use* logic *in our reasoning*. The results or truths of logic are assertions, as we have said, regarding the relations of classes and propositions. Further, these results of logic are usually formulæ, that is, propositions whose terms are variables. Thus, if *any* class a is contained in another class b, and if this class b, in turn is contained in a third class c, then the first class a is contained in the third class c; or more precisely stated, $[(a<b)(b<c)]$ implies $(a<c)$, where a, b, c, represent any class. Here is a logical formula taken from the logic of classes. How do we use it in our reasoning? Assuming it as true, we substitute constants for its variables. For example, if this formula is true, and if the class men is included in the class mortals, and if Socrates is a member of the class men, then Socrates is a member of the class mortals. Every student will agree that logic is not concerned with Socrates or man but with something more general. But notice what this means: Logic is concerned with *variables*. It gives us *formulæ*. If so, and if we always use logic in our reasoning we shall find, no matter what instance of reasoning we may take instead of the trite example aforegiven, that some formula is presupposed by it. That a formula is presupposed means that it is assumed as a premise which we have used by substituting constants in place of its variables. In short, to use logic means to sub-

stitute in a formula constants for the variables of the formula and then to assert one of the resulting propositions, namely, the one found in that part of the formula called the conclusion. But this, we know, is precisely what we do when we use physical formulæ in our reasoning."

"'Yet,' you ask, 'is not logic the science or art of correct reasoning? and is not reasoning a mental process?' No, logic is not. Of course there is such a study or art, and of course there is excellent authority for the use of the word logic as the name of this art. But the art called logic, when examined critically from the point of view of the pure sciences, is a conglomerate of many sciences applied to solving one type of practical problem. In short, it is the application of information from many scientific sources. It draws on pure logic, on psychology, on mathematics; indeed, I should fear to mention the pure science upon which it should not draw."

To conclude: the subject matter of a science depends upon the terms and relations to be found in the propositions constituting the science. In the case of logic these are such terms as propositions, propositional functions, classes, types of relation; and such terms are as truly non-mental as are rocks and ocean currents. In other words, logic is not a science of the knowing process, its principles and formulæ are not laws of thought, its terms and relations are as clearly distinct from those of thought as are the terms and relations of physics.

Formal logic has made great progress in the last sixty years (since the work of Boole, "Laws of Thought" 1854), and this progress has enabled us to see far better

the true nature of the science. It has done so in two respects. It has shown that there are other types of deduction besides the syllogism, opening up to our view especially the logic of relations; and it has shown the great value of formalism, or symbolism, for logical research. In the words of Mr. Bertrand Russell, "What is now required is to give the greatest possible development to mathematical logic, to allow to the full the importance of relations, and then to found upon this secure basis a new philosophical logic, which may hope to borrow some of the exactitude and certainty of its mathematical foundation. If this can be successfully accomplished, there is every reason to hope that the near future will be as great an epoch in pure philosophy as the immediate past has been in the principles of mathemathics."

3. Logic and existence.—Thus interpreted, logic reveals its own narrow limits, and these narrow limits cause us to call logic a non-existential science. Though the principles of logic and the calculus founded upon these principles give us, in spite of the narrowness of the science, a most important and widely useful body of information; still this information can be so formulated that it does not commit the logician to asserted existential propositions. On this account his science remains non-existential. That is, it can be so formulated that its conclusions merely assert the consequences of certain postulates without regard to the further question, Are these postulates true and which of them are found verified in the existent world? It can demonstrate that if the law of the syllogism and certain other postulates of

logic are true, then such and such formulæ for deduction are valid. But from the nature of the case it cannot demonstrate its own original premises; and as it is logically prior to all other deduction, no other science can do so either. Of course, this does not mean that the logician is in doubt about the truth of his premises or that he doubts that his conclusions are verified by existence. Nor does it mean that the existent world and perceived truths are not the stimulus to his research and the source of his information. If this were its meaning, logic would be purely arbitrary, a game instead of a science. In other words, the statement, logic is non-existential, means that the nature of existence is not a problem of logic.

FOR FURTHER STUDY READ:

Woodbridge, The Field of Logic, Congress of Arts and Science, St. Louis, 1904, Vol. I.

FOR MORE EXTENSIVE STUDY READ:

Husserl, Logische Untersuchungen.

CHAPTER XIX

THE MATHEMATICAL [1]

1. The nature of mathematics.—Nowhere has greater progress been made in philosophical thought during the past fifty years than in mathematics. Indeed this progress has been so great that it inspires the hope that "pure thought may achieve" within our century "such results as will place our time in this respect on a level with the greatest age of Greece." The world owes to the philosophical mathematicians of the nineteenth century the important discovery of the nature of mathematical truth, a discovery which helps to solve many a vexed philosophical problem. Briefly, it has been shown that the various divisions of mathematics form branches of one science, that the fundamental notions and premises of all mathematics belong to formal logic, in other words, that mathematics follows from formal logic, and finally that mathematics is a non-existential science. The discovery of the unity of mathematical science reveals that the older notion of it as the science of quantity and of space is quite erroneous. "Pure mathematics consist entirely of asservations to the effect that, if such and such a proposition is true of *anything*, then such and such

[1] If the student is not familiar with the subject-matter of this chapter he should read before studying it: Whitehead, An Introduction to Mathematics (Home University Library of Modern Knowledge); and Young, Lectures on Fundamental Concepts of Algebra and Geometry.

another proposition is true of that thing. It is essential not to discuss whether the first proposition is really true, and not to mention what the anything is, of which it is supposed to be true. Both these points would belong to applied mathematics. We start, in pure mathematics, from certain rules of inference, by which we can infer that *if* one proposition is true, then so is some other proposition. These rules of inference constitute the principles of formal logic. We then take any hypothesis that seems assuring, and deduce its consequences, *if* our hypothesis is about *anything*, and not about some one or more particular things, then our deductions constitute mathematics." [Russell]

2. *Mathematics deducible from formal logic.*—It is familiar to all students that elementary textbooks on geometry begin with a list of definitions, axioms and postulates and that the remainder of the subject is presented as a deduction from the first assumptions. Now it has been found that all of mathematics including geometry as well as arithmetic and analysis is deducible from a small number of indemonstrable propositions belonging to formal logic, such as the principle of the syllogism. Moreover, it is found that mathematics uses only a few fundamental notions and that these too are logical.

The identification of the foundations of mathematics with logical postulates and notions causes considerable misunderstanding. It does not mean that mathematics was and is discovered in this way; for no doubt intuition and imagination play as important a rôle in the discovery of mathematical truth as is usually claimed for them.

But the means by which a truth is discovered are quite irrelevant to the philosophical questions: Why is it true? What does it presuppose? Again this identification of the foundations of mathematics with logical postulates and notions does not mean that we had to wait until mathematics was explicitly and rigorously deduced from logical indemonstrables before we could know this or that mathematical proposition to be true. For example, we did not have so to demonstrate that two plus two equals four, before we knew it to be true. Still as a matter of fact, many a mathematical error and inconsistency has come to light through the effort to make mathematical demonstration thoroughly explicit and rigorous. Finally, when it is said that no new terms except those definable through logical notions are introduced into the premises of mathematical demonstrations, this statement does not mean that the act of forming a new definition is not introducing new matter, is not a foresight of the direction in which our research should proceed. Rather the statement means simply what it says, that in introducing the new notion we can define this notion ultimately in terms of logical indefinables.

3. *Mathematics as a non-existential science.*—What was said regarding the non-existential character of logic is relevant also to mathematics. Mathematics does not make assertions regarding particular things but regarding anything that fulfils certain conditions. In other words, it asserts implications between propositions which contain variables. Whether or not there exist objects which fulfil the conditions of the premises is a very important

matter, but a matter that is irrelevant to mathematics. Of course, the mathematician believes that his premises are true and believes that his results can be applied to individual existing objects; and of course, it was a study of things which made man discover numbers, space and some of their notable properties. But, to repeat, this is irrelevant to mathematics.

Indeed one of the most important philosophical lessons which mathematics teaches is that we cannot argue directly from mathematics to existence without bringing in additional information derivable only from a study of particular facts. For example, a non-euclidian space, finite in extent and its shortest distances measured on curved lines, is mathematically as genuine a possibility as is an euclidian space. Hence the question whether or not existent space is euclidian, cannot be answered by mathematics, but only by facts which can give us a crucial test between the unlike consequences of the two geometries. It even happens that we lack such a crucial test and that we may never find it. In other words, one of the great strongholds of the older rationalistic theories of reality must capitulate. Pure mathematical thought apart from empirical research will not reveal the nature of existent space and time, will not show whether our world is finite or infinite, will not tell us of the ultimate nature of matter and whether matter is continuous or discrete, monistic or atomic. Thus though mathematics is a great victory of pure thought and so a triumph for the rationalist, it is a still greater victory for the empiricist.

4. Some mathematical results of great philosophical im-

portance, (a) *class, number, order.*—Points of great importance in the philosophy of mathematics are the fundamental character of the notions of class, of membership in a class, and of order and the dependence of mathematics upon the logic of relations. In terms of the notion of class and of correspondence the notion of number is defined. A number is a class of classes whose members can be put into one to one correspondence. Without taking up the subject of numbers which the student must get from books dealing at some length with the fundamental concepts of mathematics, I will indicate briefly the importance of this definition of number. It shows that counting or any other mental process has nothing to do with the nature of number, that any order of the members of a class, and in particular the order which would be presupposed in counting, is quite irrelevant and that a class with an infinite number of members has a number as truly as has a class with a finite membership.

The notion of order is presupposed in the notion of series and this, in particular, is presupposed in geometry. That is, geometry is not a science of space but a science of series, a science of series of two or more dimensions. It is even a question if geometry and algebra are not abstractly equivalent. In any case geometry does not presuppose space but builds up the properties of space from a consideration of sets, or classes of points.

(b) *Space and time.*—This brings us to a classical problem in philosophy, the nature of space and of time. The space and time of pure mathematics are simply series of one or more dimensions. These series are infinite and

continuous aggregates respectively of points or of instants. To what extent the results of pure mathematics describe and explain existent time and space is strictly not a question in mathematics at all. Rather we shall have to say that if real space and time have certain properties (conform with certain mathematical postulates) then the mathematical consequences of these postulates are true of space and of time. How can this be ascertained? I know no way to do so other than the way we have already discussed, that is, to ascertain whether or not such a theory explains the known facts and leads to predictions verified by observations and experiment. Of course, the scientist, and every civilized man, finds a wonderful agreement between fact and mathematical prediction and is led to believe that real space and real time have indeed the properties which make such an agreement possible. None the less the nature of real space and time remains an empirical problem and the utmost degree of certainty regarding their nature warranted by our present geometrical knowledge remains high probability.

(c) *Matter, change and motion.*—As a notion of pure mathematics, or pure mechanics, matter too seems far simpler than the physical object we perceive. A material particle is an entity which correlates points of space and instants of time, that is, it is an entity related to the two types of series. Its motion is again but a correlation of different points of space with different points of time, and its rest is but a correlation of two or more instants of time with the same point of space. Strictly speaking, a moving particle is at rest at each instant of

time and point of space and its motion is but the set of different positions which are correlated through it with different instants of time. In short, change and motion are not fundamental notions, for mathematics analyzes them into correlations between series which have no such property as motion and change. The world of mathematics is static. It is all there, infinite time as truly as infinite space. It has no change or motion as we perceive these but simply the infinitely many correlations between the spatial series and the time series. In this way the mathematician solves the ancient paradoxes, known as the paradoxes of Zeno, which arose from the assumption that a moving body must move at each point of space.

Are the matter, motion and change of mathematics real? This again is to ask the question whether or not they explain fact and predict it? So great have been the triumphs of mechanical explanation and of the practical application of mechanical knowledge that it is highly probable that whatever other properties real matter and motion may have they are in some respects genuinely mechanical.

(d)—*The mathematical infinite and the continuum.*—For nothing is the philosopher more indebted to the mathematican than for clearing up the ancient and obscure notions of the infinite and the continuum, which the mathematician has now made both lucid and rigorous. A class has an infinite number of members when a part of the class can be put into one to one correspondence with the whole class. For example, the even integers 2. 4. 6. etc., can be put into one to one correspondence

with the integers, thus $\frac{1.\ 2.\ 3.\ 4.\ 5.\ 6.\ \text{etc.,}}{2.\ 4.\ 6.\ 8.\ 10.\ 12.\ \text{etc.,}}$ and so form an infinite class. Again, the points of a line an inch long can be put into one to one correspondence with the points of a line a foot long or a thousand miles long, and so these lines must be classes, or sets of infinite points. To proceed to the notion of the continuum; the continuum is a series which has as one of its several properties that between any two members there is a third member. In short, a line as a continuum has no points next to one another, for between any two indicated points there is by definition a third point.[1]

The ascertainment of the nature of the infinite and of the continuum is in particular of importance to philosophy, for it enables the mathematician to clear up several ancient paradoxes and so called antinomies regarding the infinite and the continuum. He shows that these notions are free from contradiction; and again through the non-existential character of his theories he shows that whether or not the existent world contains infinite classes and continua is an empirical question, and not a question of pure mathematics. But here again it must be added: That so many existential problems can be solved by mathematics, forces us to believe that the mathematician has been discovering fundamental and most important parts of all future theories of reality.

FOR FURTHER STUDY READ:

Russell, Recent Work on the Principles of Mathematics, *International Monthly*, 1901, *4;*

[1] Adequate knowledge of all these matters must be obtained from special books on the principles of mathematics.

Cohen, The Present Situation in the Philosophy of Mathematics, *J. of Philos., Psychol., etc.*, 1911, *8*.

FOR MORE EXTENSIVE STUDY READ:

Whitehead, An Introduction to Mathematics;
Young, J. W., Lectures on Fundamental Concepts of Algebra and Geometry;
Couturat, Les Principes des Mathématiques;
Huntington, The Continuum as a Type of Order (Offprint from *Annals of Mathematics*, 1905);
Poincaré, Science and Hypothesis;
Poincaré, Science et Méthode, Paris, 1909.

FOR ADVANCED STUDY READ:

Russell, Principles of Mathematics;
Whitehead and Russell, Principia Mathematica;
Cassirer, Substanzbegriff und Funktionsbegriff, Berlin, 1910.

CHAPTER XX

THE PHYSICAL

1. *Introduction.*—The metaphysics of the physical is especially interesting, because in no other field of science have we facts so thoroughly authentic, and theories so rigorously formulated, and at the same time so little agreement and certainty regarding the logical foundations of the science itself. Students of physics have raised several of the metaphysical issues discussed in the preceding chapters but they have raised in addition numerous and important special metaphysical issues. In these special metaphysical issues it is astonishing how far apart are the differing sides. For example, some physicists regard mechanics as the logical basis of all physics, others maintain that mechanics is but a branch of physics. Some physicists regard physical theory as genuinely existential, others believe it to imply in no way the existence of anything but the facts it explains. Some physicists are atomists and believe that all facts are to be explained ultimately in terms of mass particles and their motion; others believe that motion is only one of several irreducible forms of energy, such as heat, light, electricity, and chemical energy. Yet with all this difference in theory, there is almost complete agreement regarding the facts and the experimental results of the science. For

example, two chemists, the one believing firmly in the existence of chemical atoms, and the other questioning their existence, may agree thoroughly regarding all the experimental data of chemistry and the empirical generalizations which summarize these data.

Another factor which makes physics to-day especially interesting to the student of metaphysics is the revolutionary discoveries in the field of radioactivity. These discoveries promise to modify the foundations of physical theory in two respects: they promise to enable us to unify chemical-physical theories to a far greater extent than have the facts heretofore known; and they indicate that the laws of electricity and magnetism may prove to be logically fundamental to the remainder of physical theory.

The metaphysical problems of physics which will be studied in this chapter are the following: the definition of the physical; the rival physical theories, mechanics and energetics; and the relation between physical theory and physical existence.[1]

2. *The definition of the physical.*—One of the most obvious characteristics of physical science (including chemistry) is the large part played in it by exact measurement, and by mathematical calculation and demonstration. The facts sought in the laboratory are usually, if not always, quantitative relations between the properties of the objects studied as these objects interact, change

[1] The student who is not familiar with the subject-matter of this chapter should read before studying it some of the books and articles referred to at the end of the chapter under the heading "For further study," especially the books or articles by Soddy, Poincaré, Ostwald, Singer, Boltzmann and More.

or remain constant. Again, the theories believed to explain these facts are usually mathematical equations or deductions from mathematical equations postulated as general physical laws. Finally, the terms and relations to be found in these theories are to a large extent either mathematical or definable by mathematical expressions. For example, if we ask the physicist: What is electricity? we are liable to be told it is a term which appears in certain equations, such as Q in the equations $Q=\int I dt$, or $W=QE$. That is, electricity is a term definable by an equation, by a certain mathematical relation between certain terms. The same truth holds of most every physical term one can mention. Even when at first thought this may not seem to be true of the qualitative differences between things to which we refer in giving their chemical composition, further thought will convince us that it is true; for the better known the chemical elements have become the more do their properties turn out to be mathematical relations, such as atomic weights, specific heats and valencies. In short, physical fact and physical theory are essentially mathematical relationships.

If this be so, how shall we define the physical? The physical is a system of propositions made up on the one hand of facts, observable mathematical relations between terms, and on the other hand of the explanations of these facts. These explanations in turn are propositions asserting mathematical relations between terms, and finally these terms are either indefinable or definable by mathematical equations. In other words, the physical is a collection of measurements and their explanation.

However, this account of the physical does not yet define it completely; for the science thus defined is too broad, including not only physics but the entire field of applied mathematics. We can narrow our definition by pointing out that the facts of physics are always the relations of motion or some other type of change taking place in time and space. Thus our definition becomes, The physical is the mathematical relations found in the changes taking place in time and space and their mathematical explanation.

These changes, including the static which is the zero of change, are motion, chemical reactions, changes in temperature, changes in electro-magnetic fields, changes in light and so on through the familiar list of physical fact, which can be summed up in the words, the phenomena of matter and energy. These terms, however, have been avoided in our definition even when it would have been easier to define physical science as the science of matter and energy. They have been avoided for the sake of logical rigor, since we expect physical science to define them and not to start with them as physical indefinables, that is, we expect physics to tell us what matter and energy are rather than to presuppose that we already know what they are.

As our definition of the physical was at first too broad, is it not now too narrow? Can we limit physical science to that which can be expressed mathematically? Of course, the facts alone can decide. At present at least, physical science is tending to become altogether a science of exact measurement and mathematical explanation. In this it is radically unlike the ancient physics in which

substances and qualities are the instruments of explanation. Hence though our definition involves prophecy as well as description, it seems to be true to the convictions of our time.

3. *Mechanics and energetics.*—There are to-day in physical science at least two prominent and nearly fundamental special metaphysical problems. The first of these is whether mechanics is only a branch of physical science or is fundamental to all physical science? If mechanics is fundamental then all types of energy, such as light, heat, electricity, magnetism, gravity, and chemical energy are reducible to kinetic energy. If on the other hand mechanics is not fundamental then all or some of these types of energy are fundamental, and therefore irreducible. The second prominent special metaphysical problem is that of the relationship between physical theory and physical existence.

Before proceeding with the study of the first problem we must understand precisely what we mean by the word "irreducible." Let us take a specific instance: The temperature of a gas is said to be reducible to the kinetic energy of the molecules of the gas. Here the word reducible means that the properties correlated with the temperature of a gas are deducible from postulates held to be true of the kinetic energy of its molecules or that these properties are correlated in a one to one correspondence with properties that can be so deduced. For example, if the pressure of a gas rises with the temperature, this increase in pressure can be deduced from the more violent bombardment of the molecules whose kinetic energy increases in a one to one correspondence

with the increase in temperature. Notice that the word "reducible" is ambiguous, for it means that either a given property is deducible or that it can be put into a one to one correspondence with a property that is deducible without making explicit which of these two propositions is meant.

This ambiguity is a matter of importance. When the mechanist maintains that light is an undulation in the ether or that a chemical compound is made up of such and such chemical atoms each with its respective valence, he may mean three different things. He may mean that light is *absolutely identical with* such undulations, or that the compound is identical with the sum of its atoms; or he may mean that the properties of light or of the chemical compound are *entirely* deducible from the respective hypothesis; or again he may mean only that these properties are in a one to one correspondence with properties that are deducible. In short, when the word reducible is used, the properties to be explained may be either logically continuous or logically discontinuous with the propositions asserted in the mechanistic hypothesis. Now I believe that much misunderstanding can be avoided if the physical theorist makes explicit which he means.

The actual properties observable in the laboratory seem often logically quite discontinuous with the propositions of the theory. Light as observed is not an undulation, heat as observed is not the kinetic energy of molecules. Now this, if I mistake not, is one of the difficulties the believer in energetics finds with the mechanistic hypothesis. He believes the various types

of energy to be precisely what they are observed to be, light and heat are not motion, they are just light and heat. But the mechanist should not, and probably does not, mean either identity or complete logical continuity when he reduces these energies to kinetic energy; for he should admit that many such properties may not be identical with, but only in a one to one correspondence with, properties deducible from mechanistic theories.

If this is the meaning of the mechanist's hypothesis, the question at issue between him and the "Energetiker" becomes the questions: (1) Can all the various observable physical facts be explained by (reduced to) mechanical hypotheses, or are some of these *mechanically* inexplicable? (2) Can they be explained (in any case) in terms of general laws of energy rather than in terms of the laws of mechanics? It is evident that these questions cannot be answered *a priori,* and therefore that we must wait until we get sufficient evidence. A few years ago the evidence at hand indicated that physical facts can be explained both mechanistically and in terms of general laws of energy. Hence it could be inferred either that both hypotheses were equally valid, or that the crucial facts which would decide between them still remained undiscovered. Recently, however, there appears to be increasing evidence in favor of some of the mechanistic hypotheses, such as the atomic and molecular theory in chemistry, so that those "Energetiker" who have disputed the necessity of such an hypothesis seem to be weakening. But at the same time mechanism itself is being called in question by the new discoveries in the

field of radioactivity. Is electricity to be reduced to the mechanical? Is not rather the mechanical to be reduced to the electrical? Is not mass, or inertia, which is an ultimate in mechanics, itself reducible to the properties of electro-magnetic phenomena present when an electric charge moves? The evidence indicates that it is. In other words, "Is the unexplained inertia of matter a different thing from the elucidated inertia of electricity, or is it possible that the inertia of matter is due to the same phenomena as that of electricity, and that matter is in some unknown way compounded entirely out of electrons?" That is, *electrical theory may be logically fundamental to all other physical theories.* If this is so, the interesting metaphysical question at once arises, How many of the older fundamental postulates of physical science are to remain valid and fundamental? The future alone can give us the answer. At present, the principle of the conservation of energy appears to be valid. So also does the principle of least action, and the principle of relativity. But the principle of the equality of action and reaction is questioned; and the principle of the conservation of mass is denied. However, if the place of mechanics as the fundamental physical science is to be surrendered to electro-magnetic theory, this does not mean a victory for that type of energetics which finds in each energy a fundamental form of physical existence. It indicates rather that most of these types of energy are reducible to electro-magnetic energy. Further, it means a victory for atomism, for electricity itself has proved to be granular.

4. The relation between physical theory and physical

existence.—Nowhere in science has the question of the relation between theory and existence been raised more prominently than in physical science. The entities postulated by various theories, the chemical molecule and atom, the electron, the ether and its undulations, are far beyond our range of perception and are therefore purely hypothetical. Are then the physical theories which assume them, to be regarded as seriously entertained existential hypotheses or as merely tentative and convenient ways of explaining physical fact, but not ways which imply any other existence than the physical fact itself? For example, if we explain radiation by assuming an ether, do we assume the ether as an existent or merely as a convenient symbol in terms of which we can formulate our hypothesis or by means of which we can secure an imaginary model illustrating our theory in a concrete form? In short, is physical theory merely a collection of non-existential mathematical postulates, or is physical theory existential? Each view is held by different prominent physicists, the mechanist and the majority of physicists tending to believe that physical theory is existential, and the Energetiker tending to believe that it is not.

The grounds of disbelief in the existence of the hypothetical physical entities are four in number:—First, there are many possible rival theories explaining the same physical fact; secondly, physical theory has undergone many and radical changes in the past one hundred and fifty years; thirdly, physical theory can be formulated in purely *general* mathematical terms which in no way involve the existence of particular hypothetical entities;

finally, there is no means of verifying directly by perception the existence of such entities.

These grounds are far from conclusive. In the first place, existence, as we have learned, cannot be identified with the perceivable. Most existence is theoretical and the question, whether or not a theory is existential is the same question as whether or not it can be verified. Though it be true that physical theories are extremely hypothetical and lack crucial tests, this does not make them non-existential. It makes them only more tentative and less probable. In the second place, the unlikelihood of securing crucial tests and ample verification for physical theories does not indicate that these theories are non-existential, it indicates rather that our powers of perception are narrowly limited. Moreover, it seems foolhardy to predict what in the future will prove verifiable and what will not. Finally, even should the physical theory of the future become highly general, implying no other particular entities than those which are observable, this would not make it any the less existential, unless we are to abandon Platonic realism for extreme nominalism. In short, the problem of existence in physical science does not differ fundamentally from what it is elsewhere in science: although more difficult to verify, it is the same problem.

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CHAPTER XXI

LIFE

1. *Introduction.*—In the field of biology at the present time two special metaphysical subjects are prominent. The first is the issue between mechanism and vitalism; the second is the theory arising from mendelism, a distinctly atomistic theory of the forms of life and of their origin, a theory which virtually supersedes the older doctrine of animal and plant evolution. As the question of fact underlying each of these subjects would take us at once from metaphysics into biological science, our brief study of these matters will be confined to their meaning and philosophical importance.[1]

2. *Mechanism and vitalism.*—In the issue between mechanism and vitalism two questions appear to be involved which when rigorously formulated define the two rival theories. The first question is a special case of the problem now familiar to us, the problem of logical continuity and discontinuity. The second question arises from the first and asks whether or not each living organism is controlled by a unique factor whose office is to work out the ends or appropriate destiny of the creature. Should this second question be answered affirmatively, then life is a fundamentally different type

[1] If the student is quite unfamiliar with the subject-matter of this chapter, he should read, before studying it, the articles referred to at the end under the heading "For further study."

of existence from the lifeless. Let us turn to the first question.

That plants and animals are markedly unlike the objects of the inorganic world with which, however, they share many chemical-physical properties, is evident to all men. The mechanist admits this marked difference as fully as does the vitalist; but he points out that it is only a special type of the discontinuity to be found everywhere, even in the inorganic world. For example, he can urge that chemical compounds which are alike in their elements, the isomers, may be extremely unlike in many of their properties. *What he maintains and what the vitalist denies, is that in vital phenomena each instance of discontinuity and each element of every discontinuous property is in a one to one correspondence with some chemical-physical configuration.* Mark the word *each;* for the vitalist also admits that many discontinuous properties are in close correspondence with life's physical substructure and that it is always the business of science to try to find such correspondence. That is, even he admits that all life has an extensive and complicated chemical-physical structure as the greater part of its logical basis. What the vitalist questions, however, is that this structure forms the entire logical basis; for he is convinced that some properties of the living organism are so radically unlike any property found in any lifeless object that these properties are not in a one to one correspondence with the creature's chemical-physical structure but are logically independent.

It is difficult to see how these rival theories can be given a crucial test and to see wherein these theories

will affect differently the methods and problems of the science; for the vitalist, if consistent, will seek chemical-physical correspondence as zealously as will the mechanist. The only difference seems to be that where this correspondence is not yet found the mechanist will always hold out the hope that it may be found; whereas the vitalist will not. Still, the mechanist's position seems the stronger for two reasons, (a) because, as we have learned, discontinuity can be shown to be no argument against mechanism, and (b) because of the great physiological triumphs already won in discovering the chemical-physical correlate or cause of many vital processes. These triumphs rightly raise the hope that as in the past some vital processes which once seemed quite unlike anything explicable by chemistry and physics have been thus explained, so also in the future what now does not seem to be explicable in this way, may prove to be so.

However, the vitalist claims not only that there are vital processes without a chemical-physical correlate but that these processes can be easily discovered through their observable character. For example, a locomotive having lost a wheel cannot of itself reproduce a wheel, but certain organisms can reproduce lost members. Even the most complicated of automatic machines can react only in definite fixed ways and is absolutely at the mercy of whatever factor sets it working; whereas even the lowest forms of life will by a process of trial and error flee from or adjust themselves to many unfavorable stimuli. Indeed all organisms reveal remarkable adjustments of means to ends; and nothing strictly comparable to these adjustments is to be found in the world of purely

mechanical things. In general, such characters are teleological, and no conceivable mechanism can be their cause. They must work, at least in part, independently of the physical and be due to a cause of a fundamentally different order. This cause resembles the mind in that it works for ends and adapts means to ends. It has been called by the Aristotelian name, an entelechy.

In opposition to the doctrine that an entelechy exists in the living organism, the mechanist can urge that once we admit that discontinuity can be correlated with a continuous system, we can not limit *a priori* either the complexity or the properties of this discontinuity, especially when it is correlated with what is known to be a marvelously complicated chemical-physical machine. Thus that life is radically unlike the lifeless is paralleled by the truth that the chemical-physical machine of the living organism is radically unlike in complexity the simpler mechanisms usually thought of when the word machine is employed. How great a change in discontinuity may be correlated with this increase in mechanical complexity only the facts themselves can reveal. Even should the discontinuous properties prove to be irreducibly or fundamentally teleological, as the vitalist claims, who can tell, except the facts reveal it, what properties machines can have? In other words, the mechanist can urge in defense of his theory a broader vitalism than that of the vitalist. He can assert that if vitalism is true anywhere it is true everywhere, for everywhere in nature the discontinuous is correlated with the physical. He can deny that there is a fundamental difference in this respect between the living and the lifeless.

This reasoning, of course, does not satisfy the vitalist, for the discontinuity which he finds in the living is peculiar to life in being teleological. For myself I fail to see how logical analysis can settle this issue. Either position is logically possible, though the mechanist's position has the advantage of assuming greater uniformity throughout existence and has proved a good working hypothesis. In short, facts alone can reveal to us whether or not chemical-physical processes logically underlie the remarkable instances of seemingly pure teleology now urged in support of vitalism.

3. *Biological atomism.*—Besides the issue between mechanism and vitalism, the biology of to-day presents another special metaphysical subject of great interest. This is no less than the question: Is not biology giving up her older doctrine of evolution and offering us an atomic theory of life in its place? Briefly stated, the new theory teaches as follows: Each living creature is a compound of certain unit characters and differs from other organisms merely in the presence or absence of this or that unit character. All the unit characters of each adult organism are in turn merely the developed form of the unit characters in the germplasm from which that organism has sprung. But this germplasm is only a part of the total germplasm of the creature's parents, hence the creature's unit characters are only a selection out of the total collection of unit characters present in the total germplasm in the parents. Of course, the same is true in turn of the adult form of each parent relatively to this same germplasm; for though each creature is the carrier of half the germplasm to parts of which each

of its offspring will owe their parentage; still it is itself merely a selection from this same germplasm received from the preceding generation. For example, a hybrid sweet pea is the product of the germplasm selected by nature from the germplasm of two different specimens of the sweet pea. That is, it will not possess developed all the characters which that germplasm contains; for in the total germplasm from which its offspring will develop, it does possess many characters besides those which have reached maturity in its own self and therefore it can be the carrier to a new generation of qualities lacking in its own adult form. Expressed in other words, each organism is a selection of unit characters out of a germplasm which is immortal and of which it is merely the carrier from a preceding to a following generation.

Further, the total germplasm throughout the world possesses a finite number of unit characters and each living creature is simply a compound of characters selected from this total list. Hence many a new variety of organism may represent nothing new except a new selection; precisely as a hand at whist is but a new selection from the fifty two cards of the deck, even though it be a hand which we have never held before, for it contains no card which we have not previously held. To repeat, as life goes on from generation to generation, although there may be creatures unlike any which have ever before existed, yet they may be no more than a new deal of nature's deck of cards, the total unit characters in the germplasm from which they are descended. To all outward appearance there has been an evolution, a spon-

taneous arising of new types of life; but in terms of the unit characters they are not new.

These unit characters may persist through ages and there may be no new characters arising but simply new shufflings and so new selections. Hence these unit characters form atoms, in their way as truly atoms as those of chemistry or of mechanics; for as the various material objects are but new selections of atoms which have existed for untold ages, so each organism is a compound of old, it may be exceedingly old, unit characters.

However, each of these unit characters must have had a beginning sometime in the history of plant and animal life. But whatever the story of its origin, from the present point of view it was the spontaneous arising of a new atom. It was an addition to the biological world of the same sort as the arising of new chemical atoms in a cooling star. On the other hand, of course, unit characters may die out through the extinction of all organisms which happen to be their carriers. If they do, they are lost to the world forever unless they arise again spontaneously.

Now the importance of this doctrine philosophically is that, according to present biological theory, biological evolution is quite of the same general type of evolution we find in other realms of existence. Correlated with the logically discontinuous there is a system of logical continuity. Moreover, in biology this system of logical continuity is a thorough going atomism, as much so in its way as is the atomism of chemistry in another way. Thus if we mean by evolution the spontaneous generation of the new, evolution takes place

within the field of mendelian characters only when a new unit character arises spontaneously. At other times there is no evolution in this field but only a thoroughly mechanical reassortment of atoms.

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CHAPTER XXII

THE MENTAL

1. *Introduction.*—Among the prominent topics in the special metaphysics of psychological science are the following: The subject matter of psychology, or the nature of consciousness; and the relation between the mind and the body, including the problem of the existence of the soul.

2. *The subject matter of psychology.*—Regarding the subject matter of no other science perhaps is there less consensus of opinion than regarding that of psychology. One cause of this obscurity and disagreement is that a definition is sought not by analyzing logically the information which is acknowledged to be psychological but by arguing *a priori* what the subject matter of psychology ought to be. Starting thus with a preconceived notion of the mental, we are prone to read into psychology matter which is quite foreign to it, and even non-existent.

Let us accordingly consider at once certain truths regarding psychological research and doctrine which must be taken into account by anyone who defines its subject matter. (a) *Psychological research is carried on by many men co-operating.* Psychologists write books for other psychologists. The psychological investigator experiments not only on his own mind but also on the

minds of other people. In short, the *subject matter of psychology is not*, as many thinkers assert, *something absolutely private to each mind*, something that cannot be observed and experimented with by other men than the owner of the mind.[1]

[1] The belief that the mental is absolutely private and unobservable except by "its owner" leads to some remarkable conclusions. It leads to the conclusion that the only way in which we can know another mind is by inference from our own, assuming that when another organism reacts as we do, it implies that the organism has the same mental states. But if another's mind is quite unobservable, it remains possible that these reactions are controlled by mental contents quite unlike any which we have. The difficulty of ascertaining the precise color sensations of color blind patients suggests how this might be the case. In other words, I cannot be sure as I read the textbook of a psychologist that when he speaks of this or that sensory content, he means what I mean by the words he uses. Hence the conclusion, contrary to fact, consciousness cannot truly be studied in common by two psychologists. All they can do, is to study reactions and to guess at that which is correlated with these reactions.

This leads to the conclusion, which has been ably defended, that as far as psychology can show, a perfect human automaton would in no way differ from what we ordinarily believe our fellow beings to be. That is, since conduct is the sole means by which we can infer the nature of the absolutely hidden conscious states of another man, a perfect automaton would give us all the evidence of the existence of consciousness and of the nature of consciousness given by the normal being. In short, "I" may be the only conscious being and all other human beings may be automata. All this absurdity comes from the assumption, to which no psychologist really keeps faithful, that another's consciousness is private or unobservable by the psychologist studying that consciousness.

But why do some thinkers believe consciousness is absolutely private? Because they believe that when you and I see a table there are three tables: (1) The table of the external physical world; (2) a table, a conscious state in your mind; (3) a table, a conscious state in my mind. Each of these tables is believed to be an absolutely distinct existent entity. Of course, it then follows that I cannot observe the table of

(b) If we examine carefully the data or the information either got by the experimenter himself or acquired by him from other men's psychological treatises, we find that these data or this information is made up of two elements, first, *reactions of some sort*, secondly, *objects in the world, correlated with these reactions, which can be observed in common by all students*. By reactions I mean not only motions of arms, legs, and in general the muscles, but also the written and oral answers to questions. By objects of common observation I mean such entities as colors, sounds, odors, things, motions, and differences between one object and another. We never get as a datum that which by its very definition is unattainable, the so called private sensations, mental images, and thoughts of the patient. If we get his sensations, we must get something *we also* can observe; and if we get his thoughts, the same is true. In short, we learn *the objects to which he is reacting and the reactions*. Did we remain ignorant of either, psychology as a science would vanish altogether. (c) The psychologist is very much interested in the structure and the function of the nervous system, and in all that affects the functioning of the neurons. Yet his science is distinct from neural anatomy and physiology; for what he is studying is not the nervous system but something peculiarly related to the nervous system, and indeed to the entire organism.

your consciousness, for the only table of which I can be conscious is an absolutely distinct and unique entity, the table of my consciousness. The step from this belief to idealism and general subjectivism is a short one. Fortunately, it is also a belief that though entertained at times by many a psychologist is seldom actually followed in practice. If it were consistently held to, there would be no psychology.

If we keep these three points in mind what must be our answer to the question before us? The subject matter of psychology is *the nature, the complexity, and the structure of that which controls reactions, and of the way it acquires this control.* Not to enter into the study of psychology but solely to illustrate this abstruse definition, let us see what it implies in concrete examples. The psychologist might wish to learn what controls a rat's motions as the rat runs through a maze. Is it color, is it odor, or is it some other property of the maze? Again, in examining the intelligence of a child, he endeavors to learn what qualities, aspects, relations of things, and what small differences in all these will affect the child's reactions. That he can sometimes ask the child and get the child's own report, does not alter the object of his search. Nor does it alter the object of his search if he names his investigation, a study of the child's sensations. "The child's sensations" means the objects to which the child reacts. Or he may study the child's ability to learn, that is the alteration in reaction and the alteration in the ability of an object to affect reaction, as that which we call training proceeds.

Again, he may be studying memory and thought. How far and under what conditions will the patient react to past objects? How far and under what conditions will the patient react to the abstract relations between abstract entities? He calls a child stupid because it will not react properly to the question: What is the opposite of "out doors," of "play," of "love"? Finally, in the psychologist's own introspection, what is he studying? As we have seen, he is studying something he can

communicate to us. If so, the objects studied must be of the same sort as those he himself studies in his patients, that is, the qualities and relations which affect reaction. To take a crucial case, let us say he is studying his own mental imagery. He is examining perhaps the color, the vagueness, the instability of the content to which he is reacting in a way called "attending;" or again he is noticing perhaps the absence of this or that content as a controller of his conduct. In either case, it is not the content just as content which is studied, but the nature of the content controlling his reaction. He asks: What is the nature of this content, how complex is it, what rôle does it play in his reactions, and how did it come to play this rôle? All of this he can communicate to us; for the only thing private about it, is that he had an opportunity to observe it which we did not have. Moreover, one cannot decide *a priori* that experimental conditions cannot be invented by means of which all that introspection reveals, can be discovered by the outside observer. Indeed in daily life we often can learn a man's thoughts or even dreams by watching his behavior.

To return to the definition of the subject matter of psychology, I believe that a logical analysis of the information called psychological will show that it has to do with two systems of things which control our reactions: first, the system of things which is ordinarily described as "that to which we are reacting;" and second, the system of things called "the inborn and acquired connections," which make these reactions possible. If we name the subject of psychological study, the mental, then the mental consists of these two systems, that to

which an organism reacts, and that which makes the organism capable of so reacting. The mental is not something private in an absolute sense. It is not privately owned in an absolute sense. It is not privately observed in an absolute sense. The mental is not a *stuff*, or substance, not a new kind of content, or quality. It is a relationship between observable entities.

3. *The nature of consciousness.—Consciousness is then a relation.* A content becomes consciousness by becoming related in a certain way. In what way? By *becoming the object to which an organism reacts.* Thus, my hat is part of my consciousness, or as we ordinarily say, I perceive my hat, if its color, shape, and other properties control my reaction, for example, lead to my picking it up and placing it upon my head. "Two plus two equals four" is one of my thoughts, provided this relationship between the number two and itself controls my conduct and leads me to put two two cent stamps on a letter requiring four cents postage. But the hat out of such a relation is not consciousness; nor is the proposition "two plus two equals four."

There are two objections to this doctrine, or rather possible misunderstandings of it, which we must study at least briefly. First, how are we to distinguish between conscious reaction and blind reflexes? Second, is not this definition of consciousness an out and out materialism? In the blind reflex we do react to a stimulus (the chemical or physical effect an entity may have upon the neural afferent end organs), but not to the object, its qualities and its relations. True, it is sometimes very difficult to ascertain what is the controller of a reaction.

for sometimes the two types of reaction appear to be identical. But our only method of ascertaining is to eliminate experimentally, as in experimenting with animals, one thing after another until we do succeed in ascertaining. To repeat, in the case of the blind reflex the stimulus and the nature of the organism determine the reaction, not the nature of the object. Whereas in the conscious reaction, things, their qualities, and their relations determine the organism's reactions. Of course, the organism has to have the structure or the ability to function in response to such objects; for it is this ability which makes us conscious beings: and of course the organism has to be stimulated to function. In the blind reflexes it is the chemical-physical effects of the object actually acting upon our organs, together with the nature of the organism itself, which completely accounts for the reaction. In the conscious reaction we have to appeal in addition to the many other properties and relations of the object in order to explain the reaction; and often the object is such that it has no chemical-physical effect upon us, at least at that time, for example, objects thought of but not sensed. That is to say, if an animal's reaction can be accounted for wholly by the chemical-physical effect of an object acting upon it we should regard the reaction as a mere tropism or reflex. But if we could show that color, as color, or some relation between a color and things implied by color (e. g. a red flag as a sign of danger) controlled the reaction, we should have to call it conscious.

This definition is not a materialism. Materialism is, strictly speaking, a doctrine regarding the nature

of substance. This definition does not presuppose substance, but only terms and their relations. Moreover, this definition identifies in no way consciousness and the physical. Rather what it implies is that *the physical too is only a relation.* In short, the same terms in one relation are physical, in another relation are mental. The content or terms, apart from their relations, are neither mental nor physical. For example, a blue, let us say, the blue of a flag, is as a mere quality, a blue. It is not mental, nor is it physical. To be physical it must have certain quantitative relationships which cause other quantitative relationships in other things. For example, there may be a relation between its blueness and chemical effects on a sensitive plate exposed to its light by means of a camera. To be consciousness, this blue as such through its relations or implications, must influence the conduct of an organism. For example, it may lead us to articulate the words "Union Jack." Moreover, materialism identifies consciousness with unknown chemical-physical events taking place in the nervous system. The relational theory does *not.* Consciousness is not usually in the body. My consciousness of this page is literally the page, the page in certain relations. To conclude: Consciousness has been compared to a search light which illuminates, or selects out of a world of objects, certain entities, but in so illuminating or selecting it neither creates them nor takes them out of their environment. That is, *a field of consciousness is a certain cross section, a certain collection, of entities, belonging to the universe of subsistent entities and definable as a group by its peculiar relation to our bodily reactions.*

This definition thus eliminates the old dualism which divides the world into two types of substances remarkably like one another, mental states and material things. To one accepting this dualism the sensation blue and the physical blue are so much alike that it is impossible to tell which is which, and though both are asserted to be present it is impossible to find two blues. It is this dualism, really a substance hypothesis, which is the origin of idealism. For example, it was argued that, since when I perceive a blue, I can find only one blue thing, the blueness must be mental and not physical. Materialism on the other hand could retort, since there is but one blue here and that is physical, there is no consciousness. A correct definition of consciousness must make it possible for one and the same blue to be both physical and mental, physical in one set of relations and mental in another.

4. *The relation between mind and body.*—The older doctrine regarding the nature of consciousness (which teaches that it is a stuff, a stuff different in kind from matter, another stuff) implied, as was discovered when the subject was thought through, that mind and body cannot interact. Many contemporary pyschologists and philosophers are still under the spell of this old doctrine, or a modified form of it, and teach parallelism, when nothing but a metaphysical bias could possibly lead them to interpret the commonplace facts of mental and bodily life in this way. The argument is brought forward, that the principle of the conversation of energy implies that the chemical-physical processes in our nervous system cannot pass over into a form of existence

which is not energy. Conversely, thoughts cannot give rise to energy, for they themselves are not energy. This argument is metaphysically absurd. The same type of argument would prove that ether undulations cannot give rise to blue color because blue is not an energy. It is our old acquaintance the problem of logical continuity and logical discontinuity. True, the mental is logically discontinuous with the physical, but logical discontinuity of one sort or another meets us everywhere in nature. Correlated with one mechanical configuration we find such and such a quality. Change the configuration and another quite different quality has arisen. This is commonplace natural history. It has nothing to do with the conservation of energy, for the conservation of energy implies simply a certain logical continuity throughout all physical processes. It does not deny all spontaneity. It denies spontaneity only in certain respects.

The mental is then logically discontinuous with the chemical-physical system with which it is correlated. As such it cannot be explained in terms of that system. It has to be accepted in this relation simply as fact. If such an assertion is mystery, so is all discontinuity. In other words we are thrown back to the study of fact; and if we set aside metaphysics and put our question directly to the facts, is there any other way to account for the facts of mental life except the theory of causal relationship between our thoughts and our conduct? Surely every test in the form of fact is consistent with the interaction hypothesis.

5. *The soul.*—There is, however, a genuine problem involved in this relation between the body and the mind.

Are all mental states in a one to one correspondence with the chemical-physical processes in the neurons of our central nervous system? This is the problem of the existence of the soul.

If all mental states are indeed in a one to one correspondence with the chemical-physical processes, and are therefore simply discontinuous phenomena arising spontaneously when certain as yet unknown chemical-physical configurations exist in our nervous system, then mental states cannot appropriately be called the states of some further non-physical entity, the soul. They cannot be so called any more than the blue of the rainbow can be ascribed to a non-physical entity. If on the other hand the mental states are not in such a one to one correspondence with the states of the body, then they can be properly ascribed to a distinct entity, the soul. As the states of a soul they are independent of the body and can possibly exist though the body perish. Does the soul exist or are mental states in a one to one correspondence with states of the nervous system? Metaphysics cannot answer, for it is a question of fact. Either hypothesis is metaphysically, that is logically, quite sound. The question must then be left to the psychologist to answer by discovering some crucial experiment.

Metaphysically, however, the question is interesting in two respects. First, it is part of that larger question: Has the world one logically continuous system, forming as it were the great logical skeleton of the universe, with whose members all else which exists is in a one to one correspondence? There is no doubt a tendency in mod-

ern science to assume this and to find in mechanics or physics the science which reveals to us the nature of this continuous system. Indeed this postulate has been long a firm conviction among natural scientists. But in our own day we are hearing this postulate questioned on many sides. Vitalism in biology explicitly disputes it. A renewal of the soul hypothesis in pyschology is also explicitly denying its truth.

Secondly, the soul-problem is metaphysically interesting because it is *inherently* very difficult to solve, as is also the problem of vitalism. Further and further evidence of a one to one correspondence in either of these problems, as this or that physiological or psychological discovery is made, is never a convincing proof; for our present ignorance is great and the field of possible independence on the part of life and of consciousness remains vast. One thing, however, all scientists are agreed upon, that we should ever seek this one to one correspondence between the terms of the logically continuous and the terms of the related logically discontinuous.

FOR FURTHER STUDY READ:

Perry, Present Philosophical Tendencies, Chap. xii;

James, Does Consciousness Exist? *J. of Philos., Psychol., etc.*, 1904, *1;*

James, The Place of Affectional Facts in a World of Pure Experience, *J. of Philos., Psychol., etc.*, 1905, *2;*

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Montague, The Relational Theory of Consciousness and Its Realistic Implications, *J. of Philos., Psychol., etc.*, 1905, *2;*
Bawden, The Functional View of the Relation between the Psychical and the Physical, *Philos. Review*, 1902, *11;*
Paulsen, Introduction to Philosophy, 87–144;
Thilly, The Theory of Interaction, *Philos. Review*, 1901, *10;*
Carr, The Theory of Psycho-physical Parallelism as a Working Hypothesis in Psychology, *Proc. Aristotel. Soc.*, 1911, *11;*
The New Realism, essays by Montague, Holt, and Pitkin.

FOR MORE EXTENSIVE STUDY READ:

McDougal, Body and Mind;
Strong, Why the Mind has a Body;
Ward, Naturalism and Agnosticism, Part III;
Bergson, Matter and Memory.

INDEX

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